TP03 PLC USER Manual



TP03 Programmable Logic Controller

TECO Electric & Machinery Co., Ltd.

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Chapter 1 TP03 Introduction

TP03 is the latest generation of PLC developed by TECO. The high-speed and high-quality programmable logic controller has following features:

- High speed of executive time. Basic instructions: 0.31us / step (ANDB), 0.45us/step (LD)
- Large memory capacity:
  Program memory capacity: 4~8~16k steps. The product has integrated basic and application instructions, such as operation instructions, ADD/SUB/MUL/DIV…etc. trigonometry instructions as SIN /COS /TAN…, matrix input, and other instructions as matrix input, 7-seg output, and PID.
- Flexible expansion ability
  Basic units: 14/20/26/30/36/40/60 point types, max can expand to 256 digital points. 60/10 (12 bits) analog input /output
- 3 communication ports, and with 3 functions (please refer to Chapter 3: communication port for detailed information) are available for Basic unit. Using any one of them can establish a network.. PC/PDA port is also for download/upload the program to/from TP03.
  Computer link: ONE computer can control as many as 255 TP03s.
  Data link: When a TP03 is set as master, it can control other 15 TP03s. Each PLC can receive max (64 bits+8 words) ×15 data.
  Remote I/O: TP03 is set as master; it can control as much as 4 other TP03s. Each slaver has MAX input 36 points; output 24 points:
  Compliant with Modbus: Modbus protocol has embeded in TP03. It's easy to comminucation with invert or HMI.
- Built-in RTC, PWM, RUN/STOP switch, two VR (potentiometers), flash memory, and the product is available for expansion modules, A/D, D/A module and etc.
- Built-in high speed 100K pulse output which can control servo controller.
- High speed counter:
  With max speed 100K single phase, the counter has the function of two/single phase high speed and interruption input which enable precisely controlling the pulse input signal from encoder.
- TP03 series products have the same height: 90mm.
- TP03 is very easy to operate for those who have used Mitsubishi FX series.
- Profibus-DP, DeviceNet, EtherNet (TCP/IP) communication module is optional
- Easy to maintain and installation, as terminal block is pluggable (only 40/60 points type), Din rail installation
- PDA edits software (programming language: instruction list, IL)
- TP02 expansion modules are available for TP03
- The three programming languages, LD (Ladder Diagram, IL(Instruction List) and SFC (Sequential Function Chart) are all available for TP03.
- The system program can be updated directly by the controller

Chapter 1 TP03 Introduction

1 Model type description

◆ Main Module Type No. description

TP03 - 20 M R - A

- **Power supply** A: AC 100 – 240V
  D: DC 24V
- **Output** R: Relay
  T: NPN transistor
- **Function** M: Standard
  H: Advanced
  S: Simple
- **Point** 14: 14 point
  20: 20 point
  26: 26 point
  30: 30 point
  36: 36 point
  40: 40 point
  60: 60 point
- Product Series

◆ Expansion module Type No. description

TP03 - 32 E M R

- **Input/Output type**
  D: 24VDC Input (Module type is X only)
  R: Relay Output
  T: NPN transistor
- **Module type**
  M: 24VDC input point and output point share half each
  X: all points are 24VDC input
  Y: all points are for output
- **E**: Expansion module
- **Point**
  16: 16 point
  32: 32 point
- **Product series**

◆ TP03-01SPS-A : Power expansion module

◆ Analog expansion module Type No. description

TP03 - 8 AD

- **Analog module type**
  AD: analog input
  DA: analog output
  MA: analog input and output
  RD: PT-1000 temperature input
  PT: J/K temperature input
- **Channel**
  2: 2channels
  4: 4 channels
  8: 8 channels
  3: Output: 1 channel Input: 2 channel (MA available)
- **Product series**

2 Product type

2.1 Basic module list

<table>
<tr><th rowspan="2">Type</th><th rowspan="2">Rated current</th><th rowspan="2">User's 24vDC battery</th><th colspan="3">Input point</th><th colspan="3">Output point</th><th rowspan="2">dimension</th></tr>
<tr><th>point</th><th>type</th><th>Input current</th><th>point</th><th>type</th><th>Max output point</th></tr>
<tr><td>TP03-14SR-A</td><td rowspan="10">85~264 VAC</td><td rowspan="4">250mA</td><td>8</td><td rowspan="18">24VDC</td><td rowspan="18">7mA</td><td>6</td><td rowspan="12">Relay</td><td rowspan="12">2A/point</td><td rowspan="5">116×92×64mm See Fig3 177×92×64mm See Fig4</td></tr>
<tr><td>TP03-20SR-A</td><td>12</td><td>8</td></tr>
<tr><td>TP03-26SR-A</td><td>16</td><td>16</td></tr>
<tr><td>TP03-36SR-A</td><td>20</td><td>16</td></tr>
<tr><td>TP03-20MR-A</td><td rowspan="4">300mA</td><td>12</td><td>8</td></tr>
<tr><td>TP03-30MR-A</td><td>16</td><td>14</td><td rowspan="3">116×90×83mm See Fig1</td></tr>
<tr><td>TP03-20HR-A</td><td>12</td><td>8</td></tr>
<tr><td>TP03-30HR-A</td><td>16</td><td>14</td></tr>
<tr><td>TP03-40HR-A</td><td rowspan="2">500mA</td><td>24</td><td>16</td><td rowspan="4">177×90×83mm See Fig 2</td></tr>
<tr><td>TP03-60HR-A</td><td>36</td><td>24</td></tr>
<tr><td>TP03-40HR-D</td><td rowspan="2">19.2~28.8 VDC</td><td rowspan="2">N.A</td><td>24</td><td>16</td></tr>
<tr><td>TP03-60HR-D</td><td>36</td><td>24</td></tr>
<tr><td>TP03-20MT-A</td><td rowspan="6">85~264 VAC</td><td rowspan="4">300mA</td><td>12</td><td>8</td><td rowspan="6">transistor</td><td rowspan="6">0.3A/point</td><td rowspan="4">116×90×83mm See Fig 1</td></tr>
<tr><td>TP03-30MT-A</td><td>16</td><td>14</td></tr>
<tr><td>TP03-20HT-A</td><td>12</td><td>8</td></tr>
<tr><td>TP03-30HT-A</td><td>16</td><td>14</td></tr>
<tr><td>TP03-40HT-A</td><td rowspan="2">500mA</td><td>24</td><td>16</td><td rowspan="2">177×90×87mm See Fig 2</td></tr>
<tr><td>TP03-60HT-A</td><td>36</td><td>24</td></tr>
</table>

Profile referring figure:

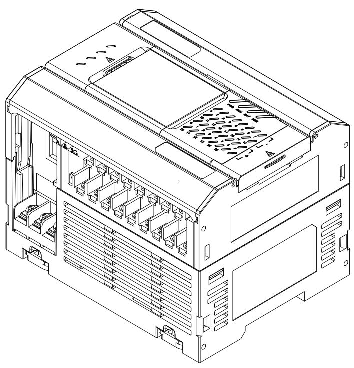


Fig 1

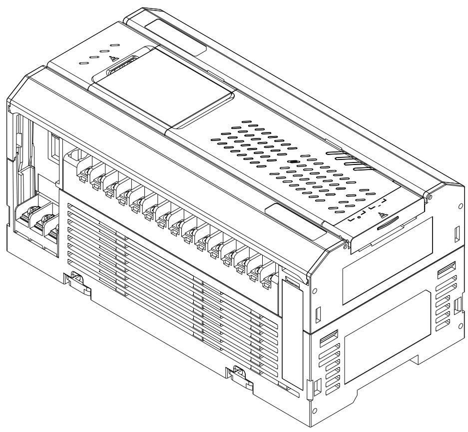


Fig 2

Chapter 1　TP03 Introduction

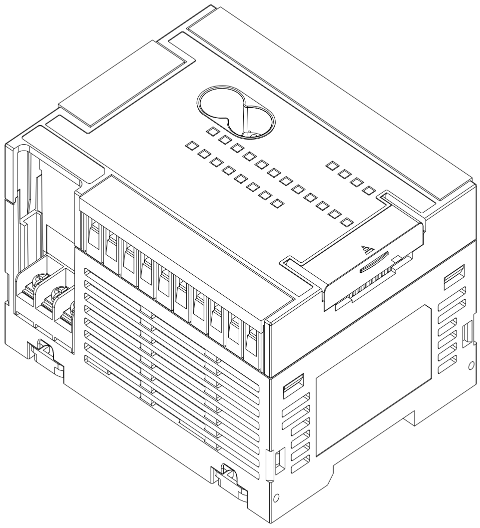


Fig 3

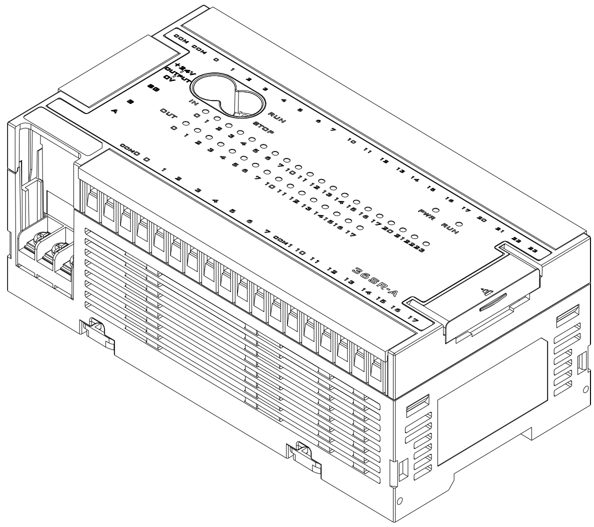
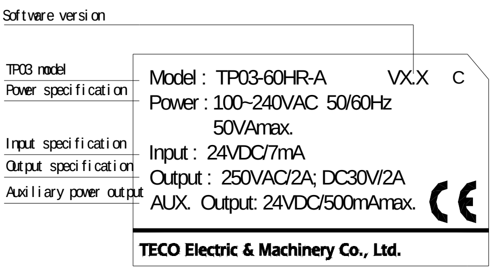
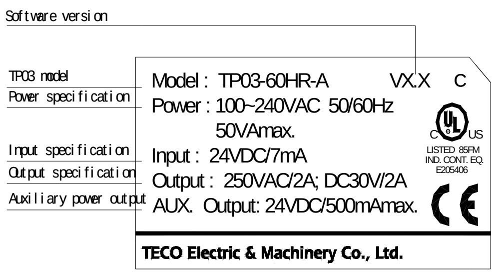


Fig 4

◆　Nameplate description





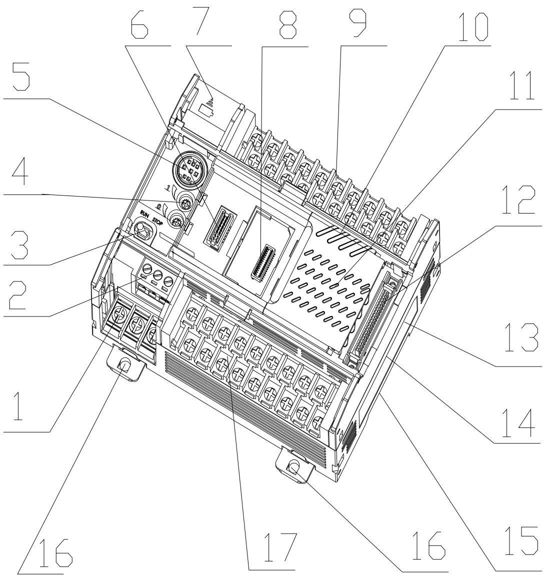
◆　Series number/Bar Code description

(21) Y WW A BCD XXX 28 01020304

- 01020304 — Hardware version (01~99)
- 28 — Software version(01~99)
- XXX — Manufacture s/n（000~999）
- BCD — Product code (000~999)
- A — Producing plant code(0)
- WW — Producing Week (01~53)
- Y — Producing year (0~9)
- (21) — Fixed code (21)

Chapter 1　TP03 Introduction

◆　Product profile and components introduction



1. Power supply terminals
2. RS485 port
3. Run/stop switch
4. 2 groups of potentiometer
5. PC/PDA communication port
6. Expansion port
7. Battery
8. Memory pack port
9. Input terminal block
10. Running indicator
11. Input and output indicator
12. Expansion connector
13. Product label
14. Series number
15. DIN rail groove
16. retractable installation hole
17. Output terminal block

Chapter 1　TP03 Introduction

2.2 Expansion module list

◆　Peripheral equipment

Type No.	Power Source	Description	Remark
OP07	N.A	2 line LCD, timer and counter setting device	Fig 5
OP08	24Vdc	2 line LCD, timer and counter setting device	Fig 5

Profile referring figure:

OP07/OP08

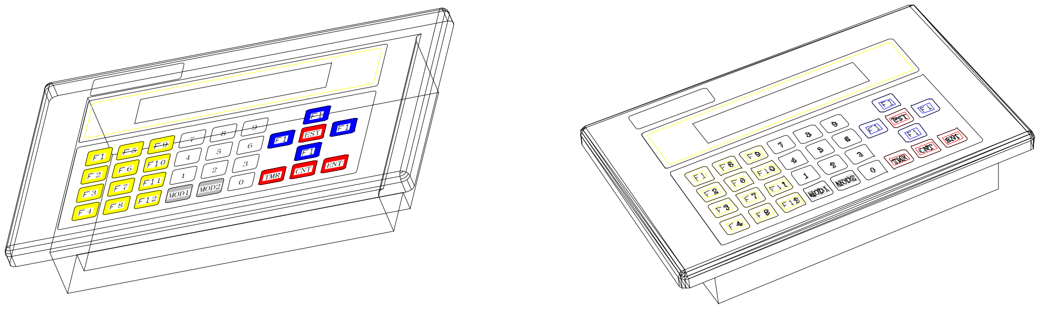
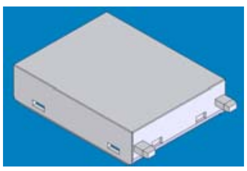


Fig 5

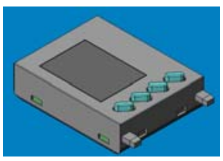
◆　Expansion card

Type No.		description	Remark
TP03-0CV	Built-in	Standard cover	(Fig 6)
TP03-1OP		Compact timer and counter setting device	In developing (Fig 7)
TP03-6AV		Analog potentiometer input port*6	In developing (Fig 8)
TP03-2TI		Timer (0~30S) input port*2	In developing (Fig 9)
TP03-232RS	Optional	RS232 communication port	(Fig 10)
TP03-485RS		RS485 multi-function communication port	(Fig 11)
TP03-2AI		0~10V analog input port *2(10 bit)	In developing (Fig 12)
TP03-1ME		Memory pack	(Fig 13)

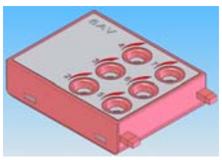
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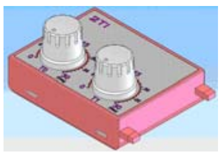
TP03-0CV (Fig 6)



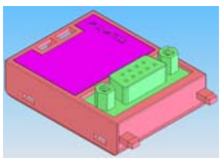
TP03-1OP (Fig 7)



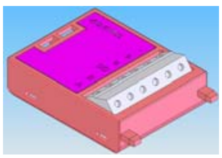
TP03-6AV (Fig 8)



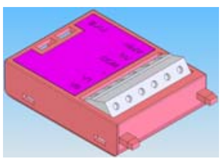
TP03-2TI　(Fig 9)



TP03-232RS (Fig 10)



TP03-485RS (Fig 11)



TP03-2AI (Fig 12)



TP03-1ME (Fig 13)

Chapter 1　TP03 Introduction

◆　Expansion module

Type No.	Power Source	In/out point	Description	dimension	Remark
TP02-16EXD	N.A	16 / 0	16 points DC input	64 x 90 x 76 mm	These modules are all available for both TP02 and TP03. (Fig 14) (Fig 15) (Fig 17)
TP02-16EYR		0 / 16	16 points relay output		
TP02-16EYT		0 / 16	16 points transistor output		
TP02-16EMR		8 / 8	8 points DC input & 8 points relay output		
TP02-32EMR		16 / 16	16 points DC input & 16 points relay output	110 x 90 x 76 mm	
TP02-4AD+	24Vdc	4 / 0	+/-10v,+/-20mA analog input *4 Channel	64 x 90 x 76 mm	
TP02-2DA+		0 / 2	+/-10v,+/-20mA analog output *2 channel		
TP03-01SPS-A	100～240VAC	N.A	Power source for Expansion modules	57 x 90 x 83 mm (Fig 14) (Fig 16)	Fig 18
TP03-4RD	24Vdc	4 / 0	PT1000 temperature input *4 channel		In developing
TP03-4TM		4 / 0	J/K temperature input *4 channel		In developing
TP03-2DA		0 / 2	+/-10v,+/-20mA　analog output *2 channel		Fig 18
TP03-3MA		2 / 1	+/-20mA analog input *2 channel, +/-20mA analog output *1 channel		Fig 18
TP03-8AD		8 / 0	+/-20mA analog input *8 channel		Fig 18
TP03-16EMR	N.A	8 / 8	8 points DC input/ 8 points relay output module		Fig 16
TP03-16EMT	N.A	8 / 8	8 points DC input/ 8 points transistor output module		Fig 16
TP03-16EXD	N.A	8 / 8	8 points DC input/ 8 points relay output module		Fig 16
TP03-16EYR	N.A	8 / 8	16 points relay output module		Fig 16
TP03-16EYT	N.A	8 / 8	16 points transistor output module		Fig 16

Profile referring figure:

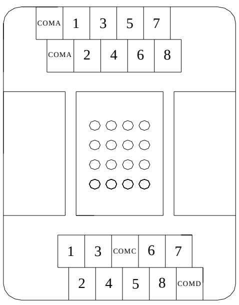


Fig 14

TP02-16EXD/ TP02-16EYR/

TP02-16EYT/ TP02-16EMR

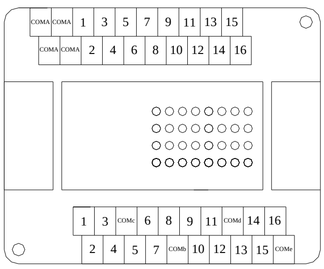


Fig 15

TP02-32EMR

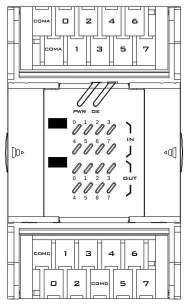


Fig 16

TP03-16EMR/ TP03-16EYR/

TP03-16EXD/TP03-16EMT/

TP03-16EYT

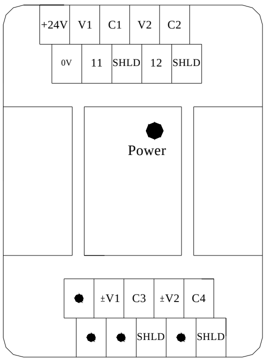


Fig 17

TP02-4AD+/ TP02-2DA+

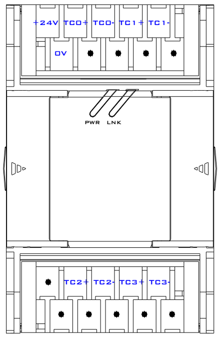


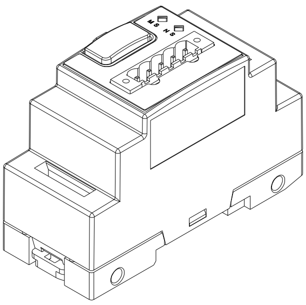
Fig 18

TP03-4RD /TP03-4TM/ TP03-2DA/
TP03-3MA/TP03-8AD/TP03-01SPS-A

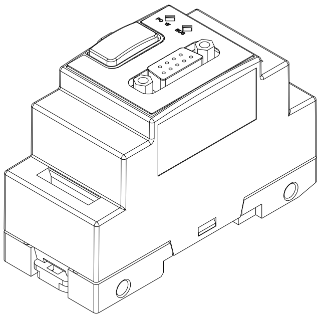
◆ Communication module

Type No.	External Input power	Description	Dimension	Remark
TP03-DNET	24Vdc	DeviceNet slaver	38 x 90 x 59 mm	In developing (Fig 19)
TP03-PBUS		Profibus-DP slaver		In developing (Fig 20)
EN01		TCP/IP		In developing (Fig 21)

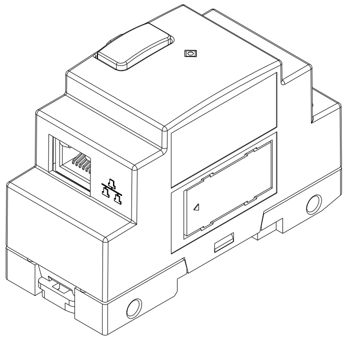
Profile referring figure:



TP03-DNET (Fig 19)



TP03-PBUS (Fig 20)



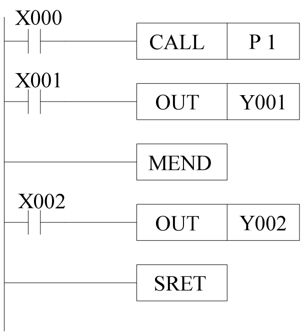
EN01 (Fig 21)

2.3 Programming tool

Type No.	Description	Remark
TP03-PC	TP03 PLC PC software (Fig 23)	The type no. for CD is TP03-CD06 (Fig 22)
TP03-PDA	TP03 PLC PDA software	



TP03-CD06 Disk (Fig 22)



TP03-PC Disk (Fig 23)

2.4 Accessory list

◆ Built-in accessory

	description		Type No.	Remark
Basic module	Built-in	Terminal connector (Fig 24)	TP-200EC	Install TP-200EC into the connector in the last expansion module in order to form a I/O loop,if no expansion module must install into the TP03 host
		Battery (for 5years)		
		RS-485 built-in (H type only)		
		Standard cover for Expansion card	TP03-0CV	
		Installation manual		
TP02 expansion module	Built-in	4cm cable for expansion module (Fig 25)	TP-042EC	14 pins, Only for TP02 expansion module
	Option	40cm cable for expansion module (Fig 25)	TP-402EC	
TP03 expansion module	Built-in	6cm cable for expansion module (Fig 26)	TP03-304EC	26 pins, Only for TP03 expansion module
	Option	40cm cable for expansion module (Fig 26)	TP03-340EC	
PC06	Built-in	1.8M cable(black) (Fig 27)	TP03-302PC	
		Compact Disk	TP03-CD06	Include: ▪ TP03-PC ▪ TP03-DPA ▪ PDF files of instruction manual & operation manual
	Option	PDA adapter (Fig 28)	JNSWPDA	
OP07/OP08	Built-in	1.8M cable (grey) (Fig 27)	TP03-302MC	
	Option	5M cable (grey) (Fig 27)	TP03-305MC	Only for OP08

Profile referring figure:

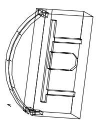


Fig 24

TP-200EC

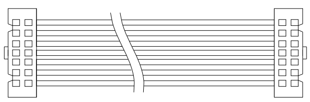


Fig 25

TP-042EC(4cm)/ TP-402EC(40cm)

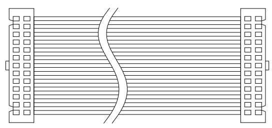


Fig 26

TP03-304EC(6cm)/TP03-340EC(40cm)

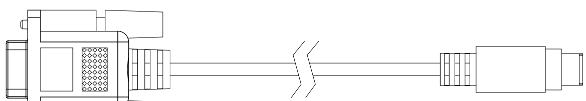


Fig 27

TP03-302PC(black) / TP03-302MC(grey)

(both items are different in outline, color and internal wiring)

TP03-305MC(grey)

(same outline and color as TP03-302MC, but different in length and internal wiring)

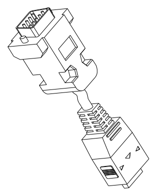
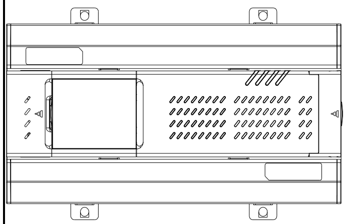
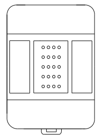
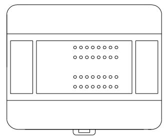
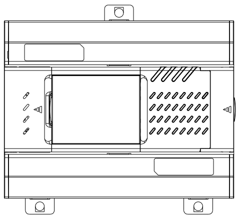
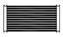
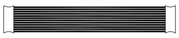
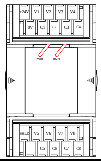
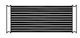
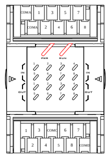


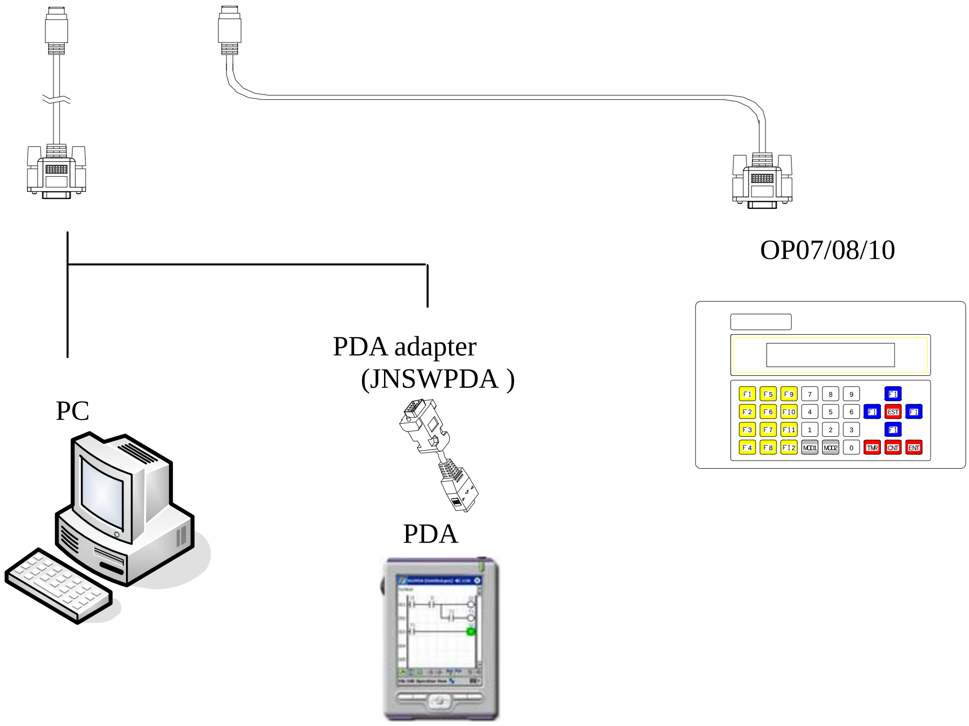
Fig 28

PDA Adapter (JNSWPDA)

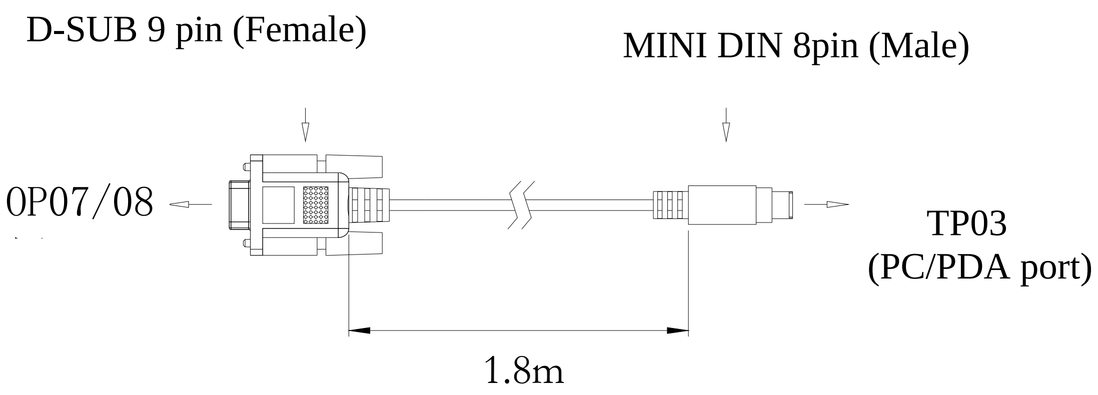
3 System configuration

Basic module	Expansion cable / Terminal connector	**TP02 expansion module**		
TP03-40/60 	Expansion cable TP-042EC (4cm)  TP-402EC(40cm)  Terminal connector TP-200EC 	TP02-16EXD/TP02-16EYR/ TP02-16EYT/TP02-16EMR/ TP02-4AD+/TP02-2DA+		
		TP02-32EMR		
TP03-20/30 	Expansion cable TP03-304EC (4cm)  TP03-340EC(40cm)  Terminal connector TP-200EC 	**TP03 expansion module**		
		TP03-4TM / TP03-4RD/ TP03-2DA / TP03-3MA / TP03-8AD/ TP03-01SPS-A		
		TP03-16EMR/TP03-16EYR/ TP03-16EXD/TP03-16EMT/ TP03-16EYT/		

PC/PDA cable (TP03-302PC)　　OP07/08/10 cable (TP03-302MC/TP03-305MC)



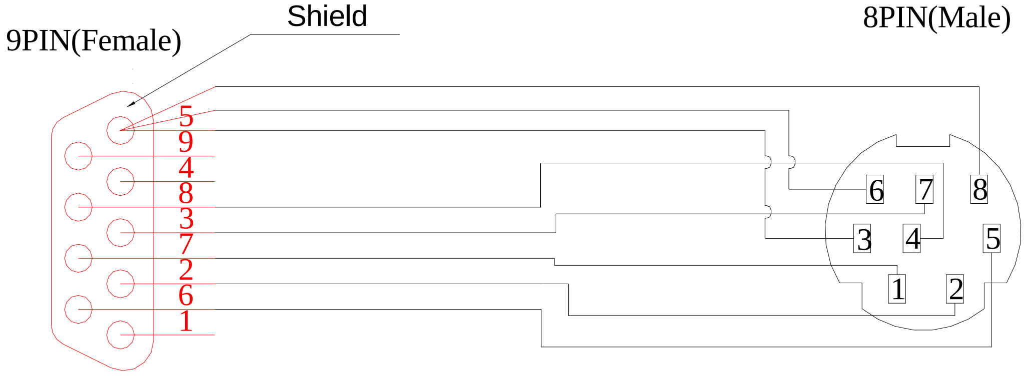
4 OP07/08-TP03 cable (TP03-302MC) specification



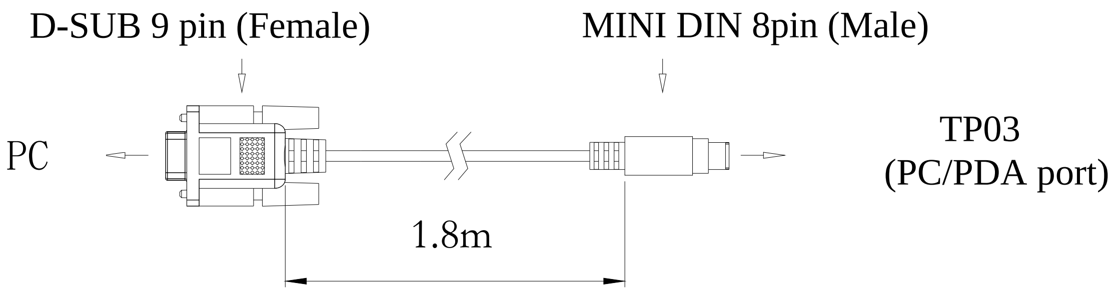
TP03-302MC D-SUB/MINI DIN pin definition and internal connection:

D-SUB 9pin(Female) (OP07/08)		MINI DIN 8pin(Male)(TP03 PG (PC/PDA) port)	
definition	pin	pin	definition
N.C	1		
TX+	2	2	RX +
RX+	3	7	TX +
N.C	4	6	GND
GND	5	3	GND
N.C	9	8	GND
Vcc	6	5	Vcc
TX-	7	1	RX -
RX-	8	4	TX -

OP07/08(TP03-302MC)



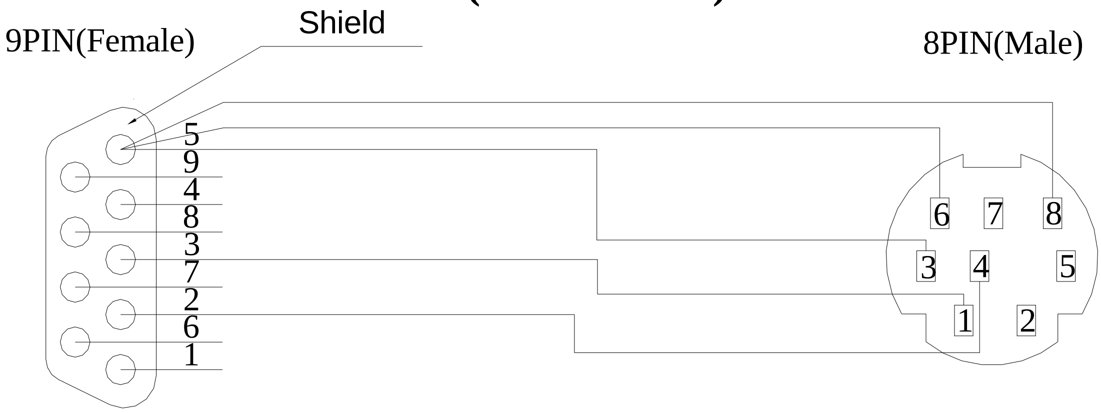
5 TP03-302PC cable specification



TP03-302PC D-SUB/MINI DIN pin definition and internal connection:

D-SUB 9pin(Female)		MINI DIN 8pin(Male)(TP03 PG (PC/PDA) port)	
definition	pin	pin	definition
RX	2	4	TX -
TX	3	1	RX -
GND	5	3	GND
		6	GND
		8	GND
		5	Vcc
		7	TX +
		2	RX +

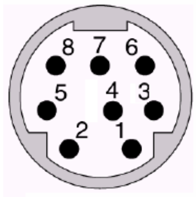
(TP03-302PC)



6 TP03 PC/PDA port connect with HMI by RS-422

Take OP10 HMI as an example

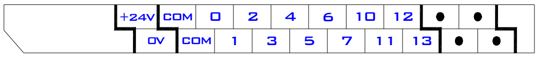
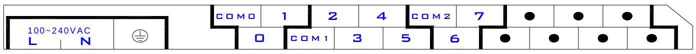
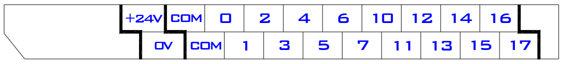
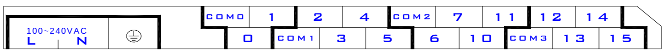
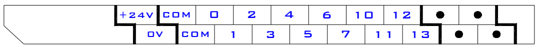
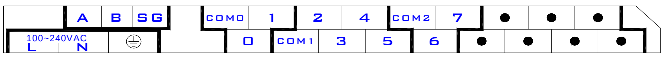
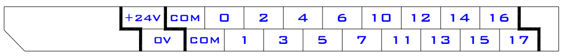
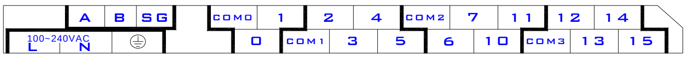
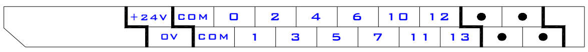
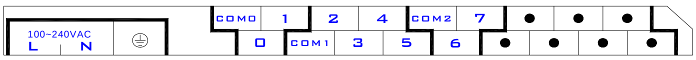
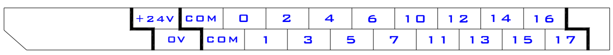
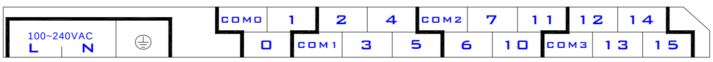
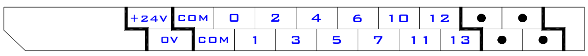
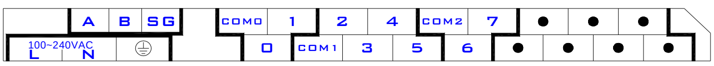
0P10 COM1	
1	TX+
2	RX
3	TX
4	NC
5	GND
6	TX-
7	VCC
8	RX-
9	RX+

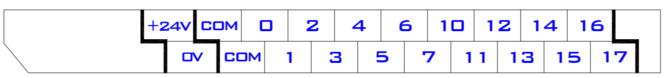
TP03 PC/PDA Port		TP03 PC/PDA port (Female)
RX-	1	
RX+	2	
GND	3	
TX-	4	
VCC	5	
GND	6	
TX+	7	
GND	8	

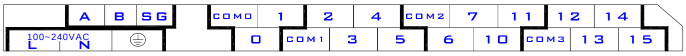
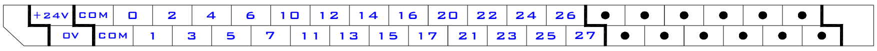
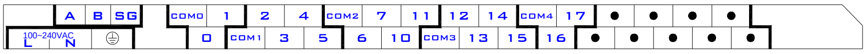
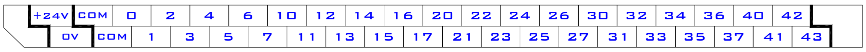
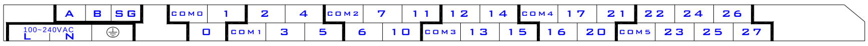
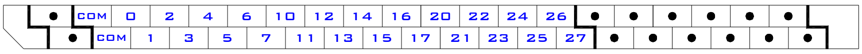
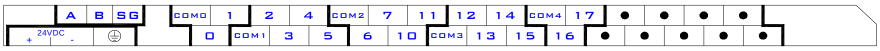
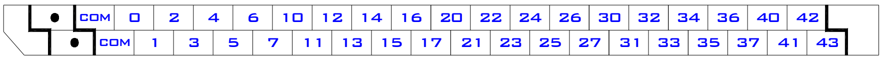
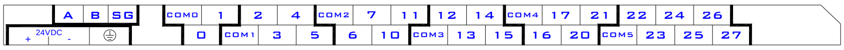
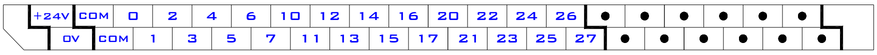
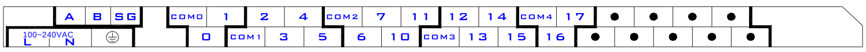
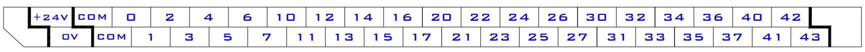
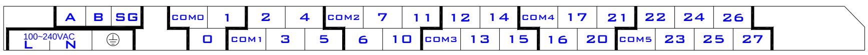
7 TP03 terminal block

TP03-14SR-A	INPUT	COM	COM	0	1	2	3	4	5	6	7												
	OUTPUT	COM0	0	1	2	3	COM1	4	5	6	7												
	COMM	+24V	0V	SG	B	A																	
TP03-20SR-A	INPUT	COM A	COM A	0	1	2	3	4	5	6	7	10	11	12	13								
	OUTPUT	COMB	0	1	2	3	COMC	4	5	6	7												
	COMM	+24V	0V	SG	B	A																	
TP03-26SR-A	INPUT	COM	COM	0	1	2	3	4	5	6	7	10	11	12	13	14	15	16	17				
	OUTPUT	COM0	0	1	2	3	4	5	6	7	COM1	10	11										
	COMM	+24V	0V	SG	B	A																	
TP03-36SR-A	INPUT	COM	COM	0	1	2	3	4	5	6	7	10	11	12	13	14	15	16	17	20	21	22	23
	OUTPUT	COM0	0	1	2	3	4	5	6	7	COM1	10	11	12	13	14	15	16	17				

Chapter 1 TP03 Introduction

	COM M	+24V | 0V | SG | B | A
TP03-20MR-A	**Input**	
	Output	
TP03-30MR-A	**Input**	
	Output	
TP03-20HR-A	**Input**	
	Output	
TP03-30HR-A	**Input**	
	Output	
TP03-20MT-A	**Input**	
	Output	
TP03-30MT-A	**Input**	
	Output	
TP03-20HT-A	**Input**	
	Output	

TP03-30HT-A	**Input**	

	Output	
TP03-40HR-A	**Input**	
	Output	
TP03-60HR-A	**Input**	
	Output	
TP03-40HR-D	**Input**	
	Output	
TP03-60HR-D	**Input**	
	Output	
TP03-40HT-A	**Input**	
	Output	
TP03-60HT-A	**Input**	
	Output	

Note: The ‘⏚’ terminal in the above table will be represented by ‘FG’ in the following chapter.

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Chapter 2 Basic Unit Specification

1 Function

(-**14**S short for S type,as 14SR-A, 20SR-A, 26SR-A,36SR-A etc

-20M short for: 20 points, M type, as TP03-**20M**R-A/TP03-**20M**T-A etc)

-40H short for: 40 points, H type, as TP03-**40H**R-A/TP03-**40H**T-A/TP03-**40H**R-D etc.)

1.1 General specification

<table>
<tr><th colspan="2">Type
Item</th><th>-14S</th><th>-20S</th><th>-26S</th><th>-36S</th><th>-20M</th><th>30M</th><th>-20H</th><th>30H</th><th>-40H</th><th>-60H</th></tr>
<tr><td colspan="2">Basic unit outline</td><td colspan="10">Brick type</td></tr>
<tr><td colspan="2">Operation control</td><td colspan="10">Reciprocating scan the program in the memory</td></tr>
<tr><td colspan="2">Input/ output</td><td colspan="10">Scanning from Start to End (End instruction) then from Start to End again</td></tr>
<tr><td colspan="2">Program language</td><td colspan="10">Ladder /Boolean/SFC (Ladder / IL / SFC)</td></tr>
<tr><td colspan="2">Program capacity</td><td colspan="4">4K steps</td><td colspan="4">8K steps</td><td colspan="2">16K steps</td></tr>
<tr><td colspan="2">Retention</td><td colspan="4">Flash retain</td><td colspan="6">Lithium power supply (with out 5 years lifespan)</td></tr>
<tr><td rowspan="2">Digital I/O</td><td>Digital input</td><td>8</td><td>12</td><td>16</td><td>20</td><td>12</td><td>16</td><td>12</td><td>16</td><td>24</td><td>36</td></tr>
<tr><td>Digital output</td><td>6</td><td>8</td><td>10</td><td>16</td><td>8</td><td>14</td><td>8</td><td>14</td><td>16</td><td>24</td></tr>
<tr><td rowspan="2">Expansion module</td><td>Digital module</td><td colspan="4">Reexpand to 80 points</td><td colspan="2">Reexpand to 128 points</td><td colspan="4">Reexpand to 256 points ※1</td></tr>
<tr><td>Analog module</td><td colspan="6">2 xTP02- 4AD^{+} & 1 x TP02-2DA^{+}
Or 1 x TP038AD &1 x TP03-2DA ※3</td><td colspan="4">1 x TP02-4AD^{+} & 1 Xtp02-2DA^{+} & 7 x TP03-8AD & 4 x TP03-2DA</td></tr>
<tr><td colspan="2">Max Analog I/O</td><td colspan="6">8 input channels /2 output channels</td><td colspan="4">60 input channels /10 output channels</td></tr>
<tr><td rowspan="4">Scan time</td><td rowspan="3">Basic instruction</td><td colspan="10">36</td></tr>
<tr><td colspan="8">ANB/ORB …ect: 0.62μs/ step</td><td colspan="2">ANB/ORB …ect: 0.31μs/ step</td></tr>
<tr><td colspan="8">LD/AND/OR…ect: 0.9μs/ step</td><td colspan="2">LD/AND/OR …ect: 0.36 --0.45μs/ step</td></tr>
<tr><td>Application instruction</td><td colspan="4">121</td><td colspan="2">133</td><td colspan="4">139</td></tr>
<tr><td rowspan="8">Relay and register</td><td>Digital I/O relay</td><td colspan="10">X000~X377(256 points) / Y000~Y377(256 points)</td></tr>
<tr><td rowspan="2">Auxiliary relay</td><td colspan="4">General auxiliary relay: M0~M1535 (1536 points)</td><td colspan="6">General auxiliary relay: M0~M7679 (7680 points)</td></tr>
<tr><td colspan="10">Special auxiliary relay: M8000~M8511 (512points)</td></tr>
<tr><td>Step relay</td><td colspan="4">S0~S1023 (1024 points)</td><td colspan="6">S0~S4095 (4096 points)</td></tr>
<tr><td>Timer</td><td colspan="4">100 points (100ms: 44 points；10ms: 46 points；1ms with accumulating function: 4 points； 100 ms with accumulating function: 6 points)</td><td colspan="6">512 points (100ms: 200 points； 10ms: 46 points; 1ms with accumulating function: 4 points; 100 ms with accumulating function: 6 points; 1ms: 256 points) . Analog potentiometer timer: 2 points</td></tr>
<tr><td>Counter</td><td colspan="4">136 points (16 bit: 100 points, 32bit: 36 points)</td><td colspan="6">256 points (16 bit: 200 points, 32bit: 56 points)</td></tr>
<tr><td rowspan="2">Data register</td><td colspan="4">General register:D0~D511(512points)</td><td colspan="6">General register:D0000~D7999(8000points);
File register:D2000~D3299 (1300 points)</td></tr>
<tr><td colspan="10">Special register:D8000~D8511 (512points)</td></tr>
</table>

Chapter 2 Basic Unit Specification

Item		-14S	-20S	-26S	-36S	-20M	30M	-20H	30H	-40H	-60H
	Index register	32points: V000~V0015 / Z000~Z0015									
	Nest pointer	Mark: N0~N7 (8points), pointer P0~P127 (128 points), input interruption pointer: I00~I30 (4points), timer interruption pointer: I6**~I8** (3points), counter interruption pointer I010~I060 (6points)				Mark: N0~N7 (8points), pointer P0~P255 (256 points), input interruption pointer: I00~I50 (6points), timer interruption pointer: I6**~I8** (3points), counter interruption pointer I010~I060 (6points)					
Constant	decimal (K)	16 Bit : -32,768~32,768 ; 32 Bit : -2,147,483,648~2,147,483,648									
	Hex (H)	16 Bit : 0~FFFFH ; 32 Bit : 0~FFFFFFFFH									
RTC		N.A.						Built-in: Second (D8013), Minute (D8014), Hour (D8015), Day(D8016), Month (D8017), Year (D8018), Week(D8019) And with 30s offset			
Run/stop Switch		Built-in									
Potentiometer		N.A.				2 points built-in and 6 points expansible (TP03-6AV optional)					
High speed input (X0~X5)	High speed counter	Single phase:4 points 10KHz				Single phase:4 points 10KHz + 2 points 5 KHz		Signal phase: 4points 100KHz+2points 5KHz			
		Two phases: 2 points 10KHz						Two phases: 2 points 50 KHz			
	Interrupt input	4points (corresponding to I00~I30): Minimum pulse width 100μs				6points (corresponding to I00~I50): Minimum pulse width 100μs		6points (corresponding to I00~I50): Minimum pulse width 10μs			
Pulse output ※2	Pulse output	N.A.				2 points: Y0/Y1 with acceleration/ deceleration					
	PWM output	N.A.				2 points: Y0/Y1					
	Frequency	N.A				1KHz max.		100KHz max.			
Communication port	PC/PDA	RS232, for upload/download program to/from TP03									
	RS485 Communication	Built-in 1 communication port for Data Link, Remote I/O or Computer Link, max. 307.2k bps				N.A.		Built-in 1 communication port for Data Link, Remote I/O or Computer Link, max. 307.2k bps			
	Expansion card	N.A.				Either RS485 or RS232 communication card is available for the port and both have Modbus communication protocol, max. 307.2k bps.					
Self-diagnosis		Input/output inspection, system processing time out inspection, illegal instruction inspection, program language syntax inspection and password set									
Supervise/ Troubleshoot		Display processing time, byte/bit character or device set									
Terminal block		Fixed, unremovable						Removable			
Dimension		116 x 92x 64 mm		177 x 92 x 64 mm		116 x 90 x 83 mm				177 x 90 x 83 mm	

※1: When basci unit's power supply for the expand module not enough, please add an external power supply.

※2: Only for transistor output type

When Y0 is set to count the output pulse, X2 can not be set as high speed counter.

Item \ Type	-14S	-20S	-26S	-36S	-20M	30M	-20H	30H	-40H	-60H
When Y1 is set to count the output pulse, X3 can not be set as high speed counter. As for M type, if the frequency exceeds specified one, the output states are maybe not right. ※3: The basic units of 20/30 points can, through setting special registers D8256 & D8258 or D8257 &, choose the analog modules either TP02 serie s or TP03 series for expanding. While basic units of 40/60 points can set through D8256~ D8259 to expand TP02 series and TP03 series analog modules which are both available for them at one time.										

1.2 AC type Power supply specification

Item \ Type	-14S	-20S	-26S	-36S	-20M	-30M	-20H	-30H	-40H	-60H
24Vdc terminal for external using	250mA(with short circuit protection)				300 mA(with short circuit protection)		500 mA(with short circuit protection)			
Power supply voltage	85 ~264 VAC									
Operation	When the supplied power increases to 75~85VAC or above, TP03 will RUN, which decreasing to 70VAC or less, TP03 will stops. The power failure lasting within 10ms will not affect TP03 normal operation.									
Consumption power	30VA								50VA	

1.3 DC type Power supply specification

Item \ Type	-40H	-60H
24VDC terminal	No	
Power supply voltage	24V DC	
Operation	When the supplied power increases to 19.2VDC or above, TP03 will RUN, while decreasing to 19VDC or less, TP03 will stop. The power failure lasting within 10ms will not affect TP03 normal operation.	
Consumption power	30W	

Chapter 2 Basic Unit Specification

1.4 General features for basic unit

- Summary
  - TP03 M type: 20 / 30 points
    - Built-in Flash memory (8,000 Steps)
    - Retentive data with lithium battery
    - Can expand 32 points and expand 2 x TP02-AD$^+$ units and 1 x TP02-2DA$^+$ unit or 1 TP03 AD unit and 1 DA unit.
  - TP03 H Type : 20/30 points
    - Built-in EEPROM (8,000 Steps) ,Built-in RTC, RS485 communication
    - Retentive data and RTC data with lithium battery
    - Removable terminal block
    - Can expand 32 points and expand 2 x TP02-AD$^+$ units and 1 x TP02-2DA$^+$ unit or 1 TP03 AD unit and 1 DA unit.
  - TP03 H Type : 40/60 points
    - Built-in EEPROM (16,000 Steps) ,Built-in RTC, RS485 communication
    - Retentive data and RTC data with lithium battery
    - Removable terminal block
    - Can expansion 64 points without external power supply
    - Can expansion another 64 points with adding an external power supply.
    - Can expand 1 x TP02-AD$^+$ unit and 1 TP02-2DA$^+$ unit and 7 x TP03 AD units and 4 x TP03 DA units
  - TP03 SR Type : 14/20/26/36 points
    - Built-in EEPROM (4,000 Steps), RS485 communication
    - Can expand 80 points
    - Can expand 8 channels AD input & 2 channels DA output

1.5 Environment specification

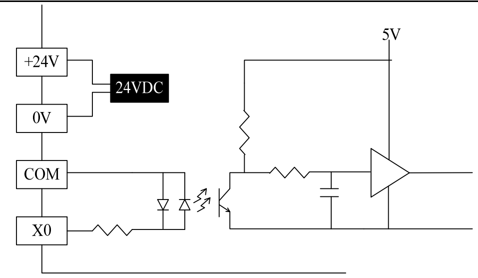
Item	-14S	-20S	-26S	-36S	-20M	-30M	-20H	-30H	-40H	-60H
Operating Temperature	0 to 55℃ (32 to 131F) (Operating ambient temperature)									
Storage Temperature	-25 to +70℃									
Relative Humidity	Level RH1, 30 to 95% (non-condensing)									
Pollution Degree	2 (IEC 60664)									
Installation category	II									
Enclosure	IP20									
Corrosion Immunity	No corrosive gases									
Altitude	Operation: 0 to 2,000m (0 to 6,565 feet) Transport: 0 to 3,000m (0 to 9,840 feet)									
Vibration Resistance	When mounted on a DIN rail: 10 to 57Hz amplitude 0.075mm, 57 to 150Hz acceleration 9.8m/sec^2 (1G) Lloyd's 2 hours per axis on each of three mutually perpendicular axis. When mounted on a panel surface: 2 to 25Hz amplitude 1.6mm, 25 to 100Hz acceleration 39.2m/sec^2 (4G) Lloyd's 90 minutes per axis on each of three mutually perpendicular axis.									
Shock Resistance	147 m/sec^2 (15G), 11ms duration, 3 shocks per axis, on three mutually perpendicular axis (IEC61131)									
Noise Immunity	1,000Vpp, 1us @30 to 100 Hz									
Dielectric withstand	1,500VAC, > 1mins between all terminals to ground (for AC type)									
Dielectric withstand	500VAC, > 1mins between all terminals to ground (for DC type)									
Insulation Resistance	500VDC, > 10M ohm between all terminals to ground									
Grounding	100 ohm or less									

2 Digital input/output

2.1 Digital input

◆ Electric specifications		
Input type	DC (sink or source)	
Voltage level	Off→On	Min. 15 VDC
	On→Off	Max. 9 VDC
Input impedance	3.3k ohm	
Current	6.7～7.2mA @24VDC	
Response time	Off→On: 1ms	
	On→Off: 2.5 ms	
Insulation	Photo-coupling	

◆ schematic diagram

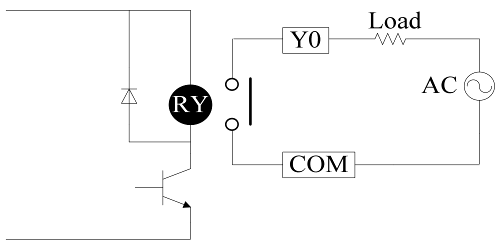


2.2 Digital output point

A . Relay output

◆ Electric specifications		
Current	2A/1 point(5A/COM)	
Voltage	250VAC /30VDC or less	
Max load	Inductive	100VA
	resistive	120W
Min Load	DC5V 1mA	
Responding time	Off→On: 6ms	
	On→Off: 6ms	

◆ schematic diagram

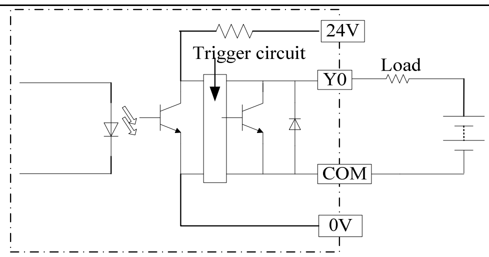


B. Transistor

■ Transistor output Y0 and Y1

◆ Electric specifications	
Current	0.3A/point (1.2A/COM)
Voltage	30VDC
Max load	9W
Min Load	10mA
Responding time	Off→On 5us
	On→Off 1us

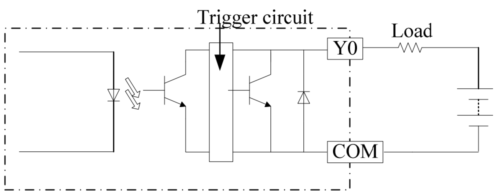
◆ schematic diagram



■ Other outputs (except above two) and all outputs on M type

◆ Electric specifications	
Current	0.3A/point (1.2A/COM)
Voltage	30VDC
Max load	9W
Min Load	10mA
Responding time	Off→On 20us
	On→Off 20us

◆ schematic diagram

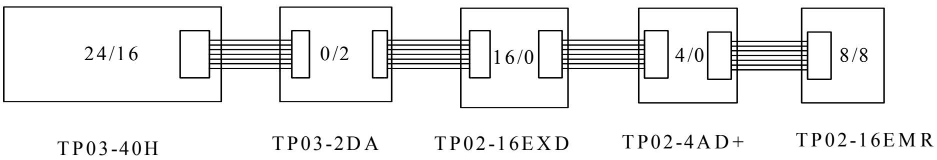


Number Arrangement for input/output

Chapter 2 Basic Unit Specification

- With respect to expansion for 20 point basic unit, the input number for the first digital (analogue) expansion unit should be start from X20 (D8436) and so on. WhileWhile the output should be start from Y10 (D8381) and so on.
- With respect to expansion for 30 point basic unit, the input number for the first digital (analogue) expansion unit should be start from X20 (D8436) and so on. WhileWhile the output should be start from Y20 (D8381) and so on.
- With respect to expansion for 40 point basic unit, the input number for the first digital (analogue) expansion unit should be start from X30 (D8436) and so on. WhileWhile the output should be start from Y20 (D8381) and so on.
- With respect to expansion for 60 point basic unit, the input number for the first digital (analogue) expansion unit should be start from X50 (D8436) and so on. WhileWhile the output should be start from Y30 (D8381) and so on.

For instance: If the user plans the following system, the number arrangement for I/O is suggested in the table below:



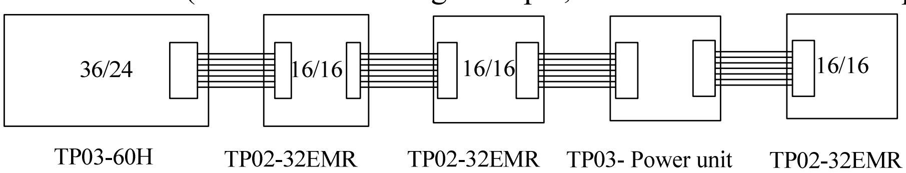
Product type	Input points	Output points	Input number	Output number	Register (for analogue)
TP03-40H	24	16	X0~X07 X0~X17 X20~X27	Y0~Y7 Y10~Y17	—
TP03-2DA	0	2	—	—	D8381 / D8382 (Output channel 1 / channel 2)
TP02-16EXD	16	0	X30~X37 X40~X47	—	—
TP02-4AD+	4	0	—	—	D8436/ D8437/ D8438/ D8439 (Input channel 1～/ channel 4)
TP02-16EMR	8	8	X50~X57	Y20~Y27	—

Note:

a. When the basic unit expanded with both the expansion unit TP3-□□□ and TP02-□□□, TP02-□□□ must be routed after TP3-□□□.

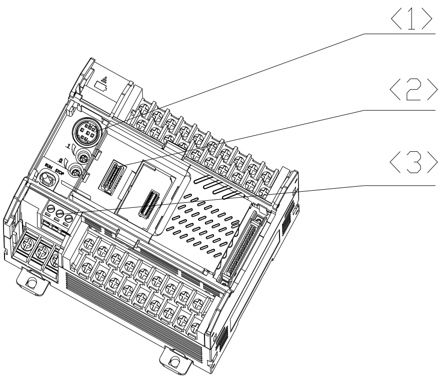
b. The basic unit TP03-20 xxx or TP03-30 xxx can expand maximum 32 points and 3 analogue units.

c. The basic unit TP03-40 xxx or TP03-60 xxx can expand maximum 64 points and 3 analogue units. An external power supply is needed if expansion units are more than that. (as for the following example, the total I/O reaches 188 points)



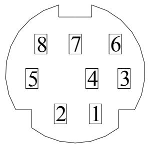
3 Communication ports

3.1 Communication ports position

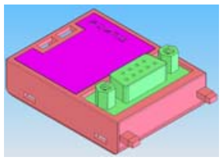


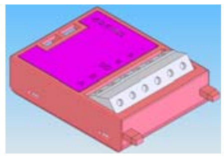
TP03 has three communication ports and see the left figure:

<1>. PC/PDA communication port

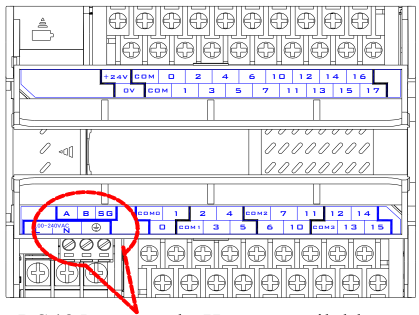


<2>. Expansion card TP3-232RS, TP3-485RS.





<3>. RS485 communication port



RS485 port, only H type available.

Note 1: The baud rate for PC/PDA port is 9.6k~57.6kbps；

Note 2: The baud rate for expansion cards and RS485 port is 9.6k~307.2kbps；

Note 3: The default baud rate for the three ports is same 19.2kbps.

Note 4: Communication modes are setting through system memory D8120, D8320 and D8321. It is recommended that sticking a label with the set data on the house of the product.

Note 5: Address number is set by PC/PDA software, it can be read throuth system memory D8121 .It is also recommended that sticking a label with the set data on the house of the product.

3.2 Function description for 3 communication port

		<1> PC/PDA port	<2> RS485/ RS232 expansion card	<3> RS485 port	**Description**
A	Program up/down load	◎			Upload or download the user program to/from TP03 or update system program.
B	Modbus slave (Only RTU)	◎	◎	◎	Available for PC/PDA monitoring the TP03. All the three ports are available for such function (refer to 3.3.1)
C	Data Link		○	○	The two ports can not be enabled simulataneously for such function.It must be used together with application instruction F190 (refer to 3.3.2 and instruction description F190)
D	Remote IO		○	○	The two ports can not be enabled simulataneously for such function.It must be used together with application instruction F191 (refer to 3.3.3 and instruction description F191)
E	RS instruction		◎	◎	The two ports can be enabled simulataneously for such function and communication protocol is unnecessary.It must be used together with application instruction F80 (refer to 3.3.4 and instruction description F80)
F	MBUS instrucditon (ASCII or RTU)		◎	◎	The two ports can be enabled simulataneously for such function and communication protocol Modbus is necessary.It must be used together with application instruction F87 (refer to 3.3.5 and instruction description F87)
Special registers for setting communication format and Baud Rate		D8321	D8320	D8120	
Remarks		Built-in	Optional	Built-in for H type	
		◎: having such function, available for more than one port using simultaneously. ○: having such function, only one port is available for such function at one time.			

Chapter 2 Basic Unit Specification

◆ Communication setting for PC/PDA port (D8321)

Item	Bit	Description	
Data length	(B0)	1: 8 bit	
Parity bit	(B2,B1)	(0, 0): no parity (0, 1): odd check	(1, 1): even check
Stop bit	(B3)	(0): 1bit	(1): 2bits
Baud rate (Kbps)	(B7,B6,B5,B4)	(0, 1, 1, 1): 9.6 (1, 0, 0, 0): 19.2	(1, 0, 0, 1): 38.4 (1, 0, 1, 0): 57.6

Note 1: PC/PDA communication port supports Modbus RTU with a fixed Data length 8bit;

Note 2: The modified data for D8321will take effect at the next scan time after communicaton finished.

Note 3: However, if D8321 is not set inside the scope, the defaulted communication format for PC/PDA will be take effect (Baud Rate: 19.2kbps; 8 bit data length, 2bit for stop bit, and without parity bit).

◆ Communication format setting for RS485 (D8120)port and Expansion card (D8320)

Item	D8120 & D8320		
	Bit	Description	
Data Length	(B0)	(0): 7 bit	(1): 8 bit
Parity bit	(B2,B1)	(0, 0): no parity (0, 1): odd parity check (1, 1): even parity	
Stop bit	(B3)	(0) : 1bit	(1) : 2bit
Baud rate(Kbps)	(B7,B6,B5,B4)	(0, 0, 1, 0) : 300 (0, 0, 1, 1): 600 (0, 1, 0, 0): 1200 (0, 1, 0, 1): 2400 (0, 1, 1, 0): 4800 (0, 1, 1, 1): 9600 (1, 0, 0, 0):19200	(1, 0, 0, 1): 38400 (1, 0, 1, 0): 57600 (1, 0, 1, 1): 76800 (1, 1, 0, 0): 128000 (1, 1, 0, 1): 153600 (1, 1, 1, 0): 307200
Start character	(B8)	(0) : NO	(1) : enabled, default: STX(02H)
End character	(B9)	(0) : NO	(1) : enabled, default: ETX(03H)
Control bits	(B10,B11,B12)	(0,0,0): control mode (without-hardware-control)→reserved	
ModBus mode	(B13)	(0) : RTU mode	(1) : ASCII mode
0	(B14)	Reserved	
0	(B15)	Reserved	

Note 1: B0~B7 for setting communication format and baud rate, which are available for all the Functions.

B8~B9 is just for RS instruction;

B10~B12, B14~B15 are reserved;

B13 is just for MBUS instruction. Only RTU mode is available for ModBus slave.

Note 2: SHL terminal should be 3 class ground or the production will be interrupted to error operation because of noise.

Note 3: COM terminal is not connected internally with FG terminal.

Note 4: The isolated twisted cable should be 0.5mm^2 with 30mm unshielded end for connecting to terminal block.

Note 5: It is necessary to add terminal resistor (120Ω,1/4W) when several PLCs are connected in the Net.

Note6: The modified data for D8320 will take effect at the next scan time after communicaton finished.

Note 7: The modified setting for D8120 will take effect at the next scan time after communicaton finished.

Note8: When using two communication port,can't set baud rate at 307.2k at the same time.

Note9: When using DLINK,RMIO,can't set 7 bit mode of the Data Length.

3.3 Three communication ports description

3.3.1 Modbus slave communication

PC/PDA communication port (built-in), RS485or RS232 expansion cards (optional) and RS485 communication port (built-in only on H type), all the three port can set up Modbus slave communication net simultaneously or respectively.

3.3.1.1 Format for Modbus slave communication

When TP03 receives command from PC, TP03 will perform according to the command and then feedback to PC. If there is an error in command content, TP03 will feedback an exception response to PC.

- Command format and response format:

<table>
<tr><td colspan="3"><— CRC range —></td><td></td></tr>
<tr><td>Slave Address</td><td>Function Code</td><td>Data</td><td>CRC-16</td></tr>
</table>

- Response format for exception:

<table>
<tr><td colspan="3"><— CRC range —></td><td></td></tr>
<tr><td>Slave Address</td><td>Function Code</td><td>Exception Code</td><td>CRC-16</td></tr>
</table>

Description

<table>
<tr><th>Slave Address:</th><th colspan="2">Function Code</th><th>Data</th><th>CRC-16 check</th><th>Exception Code</th></tr>
<tr><td>00H: broadcast to all slaves</td><td colspan="2">01H: read coil</td><td rowspan="9">Data range differs for various functions</td><td rowspan="9">CRC range includes Slave Address, Function Code and Data /Exception Code。</td><td rowspan="9">See the respective function hereafter.</td></tr>
<tr><td>01H: No.1 slave</td><td>A.</td><td>05H: write a single coil</td></tr>
<tr><td>0FH: No.15 slave</td><td>B.</td><td>0FH: write several coils</td></tr>
<tr><td>10H: No.16 slave</td><td>C.</td><td>03H: read register</td></tr>
<tr><td>….</td><td>D.</td><td>06H: write a single register</td></tr>
<tr><td>0FFH: No.255 slave</td><td>E.</td><td>10H: write several registers</td></tr>
<tr><td></td><td>F.</td><td>08H: diagnose</td></tr>
<tr><td></td><td>G.</td><td>6CH: TP03 control</td></tr>
<tr><td></td><td>H.</td><td>01H: read TP03 ID</td></tr>
</table>

Note: Responding time (Time out) at computer side covers the duration for transmitting max 256 bytes (which are varies with different baud rate) pulsing waiting time in PLC scan time.

Exception Code

Under communication linking, the controller responses the Exception Code and send Function Code adding 80H (the highest bit is set to 1) to main system if there is error happened.

Code	Name	Description
01	Illegal function	The function code is illegal for slaves.
02	Illegal data address	The address is illegal for slaves.
03	Illegal data value	Illegal data
04	Slave device failure	An unrecoverable error occurred while the server (or slave) was attempting to perform the requested action.
05	Acknowledge	Reserved
06	Slave device busy	Reserved
07	Run mode or password mode.	The function is error in run or password mode.

3.3.1.2 Function Codes description

◆ Coil Address Mapping

Register address	Content	Points	Remark
0000H~00FFH	X0~X377	256 Points	These are available for 01H, 05H and 0FH (read/ write)
0100H~01FFH	Y0~Y377	256 Points	
0200H~07FFH	M0~M1535	1536 Points	
0800H~0BFFH	S0~S1023	1024 Points	
0C00H~0DFFH	T0~T511	512 Points	
0E00H~0EFFH	C0~C255	256 Points	
0F00H~0FFFH	M8000~M8255	256 Points	
1000H~10FFH	M8256~M8511	256 Points	
1100H~1CFFH	S1024~S4095	3072 Points	
1D00H~34FFH	M1536~M7679	6144 Points	
3500H~3FFFH			

Note: TP03 input and output coil address is allocated in octal (X000~X007, Y010~Y017… X110~X117…Y370~Y077)

Other coil address is allocated in decimal (M0~M7, M8, M9, M10…M1534, M1535 C0~C7, C8, C9, C10…C255)

◆ Register address mapping

Register address	Content	Bytes number	Remarks 2
4000H~41FFH	T0~T511 Present value	1024 Bytes	03H, 06H, 10H (Read/Write) Reserved
4200H~42C7H	C0~C199 Present value	400 Bytes	
42C8H~4337H	C200~C255 Present value	224 Bytes *1	
4338H~6477H	D0~D8511 Present value	17024 Bytes	
6478H~6497H	Z0, V0~Z15, V15 Present value	64 Bytes	
6498H~6697H	T0~T511 Set value	1024 Bytes	03H(Read) Reserved
6698H~676FH	C0~C199 Set value	400 Bytes	
6760H~67CFH	C200~C255 Set value	224 Bytes *1	
67D0H~6FFFH	Reserved		

*1: High speed counter address mapping
(C200~C255, 32-bit High speed counter)

Register address		Register value	Word	
			High byte	Low byte
Present value	42C8H	C200 Low byte of present value	Low word High byte	Low word Low byte
	42C9H	C200 High byte of present value	High word High byte	High word Low byte
	……	……		
	4336H	C255 Low byte of present value	Low word High byte	Low word Low byte
	4337H	C255 High byte of present value	High word High byte	High word Low byte
Set value	6760H	C200 Low byte of set value	Low word High byte	Low word Low byte
	6761H	C200 High byte of set value	High word High byte	High word Low byte
	……	……		
	67CEH	C255 Low byte of set value	Low word High byte	Low word Low byte
	67CFH	C255 High byte of set value	High word High byte	High word Low byte

Chapter 2 Basic Unit Specification

A. 01H read coil

<table>
<tr><td>Function Code</td><td>01H</td></tr>
<tr><td>Function</td><td>This function code is used to read from 1 to 2000 consecutive status of coils in a remote device.</td></tr>
<tr><td>Format</td><td>
<table>
<tr><th colspan="4">PC → PLC</th></tr>
<tr><td colspan="3">Slave Address</td><td>01H</td></tr>
<tr><td colspan="3">Function Code</td><td>01H</td></tr>
<tr><td rowspan="4">Data</td><td rowspan="2">Start Address</td><td>High</td><td>00H</td></tr>
<tr><td>Low</td><td>13H</td></tr>
<tr><td rowspan="2">Coil number</td><td>High</td><td>00H</td></tr>
<tr><td>Low</td><td>15H</td></tr>
<tr><td colspan="2" rowspan="2">CRC-16</td><td>Low</td><td>0EH</td></tr>
<tr><td>High</td><td>90H</td></tr>
</table>
<table>
<tr><th colspan="3">PLC→PC(OK)</th></tr>
<tr><td colspan="2">Slave Address</td><td>01H</td></tr>
<tr><td colspan="2">Function Code</td><td>01H</td></tr>
<tr><td rowspan="4">Data</td><td>Bytes</td><td>03H</td></tr>
<tr><td>Output state x32-x23</td><td>CDH</td></tr>
<tr><td>Output state x42-x33</td><td>6BH</td></tr>
<tr><td>Output state x47-x43</td><td>05H</td></tr>
<tr><td rowspan="2">CRC-16</td><td>Low</td><td>40</td></tr>
<tr><td>High</td><td>12</td></tr>
</table>
<table>
<tr><th colspan="3">PLC→PC(ERROR)</th></tr>
<tr><td colspan="2">Slave Address</td><td>01H</td></tr>
<tr><td colspan="2">Function Code</td><td>81H</td></tr>
<tr><td colspan="2">Exception Code</td><td>01H</td></tr>
<tr><td rowspan="2">CRC-16</td><td>Low</td><td>80H</td></tr>
<tr><td>High</td><td>55H</td></tr>
</table>
</td></tr>
<tr><td>Remark</td><td>Byte count equals quantity of coils / 8, if the remainder is different of 0, add one.
It is recommended to set the start address equal multiple of 8, for that can improve the program efficiency.</td></tr>
</table>

In PC → PLC, coils number is 0015(H)=21(D), however 21/8=2……5. Bytes number in PLC→PC (OK) should be 2+1=3(D) =03(H) (means 3 x 8 = 24 coil states).

Address for Input coil and output coil address is octal allocated (X000~X007, X010~X017, X020~X027 ….), in PC → PLC, Start Address is 0013(H)=23(Oct),in PLC→PC(OK), the output state should be the 24 coil state from X023, that is 21 coils states (X024, X025, …., X027, X030, X031, …X036, X037, X040, X041, …, X046, X047) plus three 0s. The response data should be three bytes (8 bits are a byte), that is X23-X32, X33-X42, X43-X47. It is the same for reading Y.

In the Byte (X23~X32), X23 is Low significant bit and X32 is High significant bit. The byte is arranged from High bit to Low bit, that is X32~X23. When the responding data for X032-X023 is CD (H) = 1100 1101(B), the state for X32~X023 is ON-ON-OFF-OFF-ON-ON-OFF-ON.

Note: The maximal coil number of M/H type is 2000,the maximal coil number of S type is 960.

B. 05H write a single coil

Function Code	05H
Function	This function code is used to write a single output to either ON or OFF in a remote device.

Format

PC → PLC

Slave Address			01H
Function Code			05H
Data	Coil Address	High	01H
		Low	ACH
	Coil Value	High	FFH
		Low	00H
CRC-16		Low	4FH
		High	77H

PLC→PC(OK)

Slave Address			01H
Function Code			05H
Data	Coil Address	High	01H
		Low	ACH
	Coil Value	High	FFH
		Low	00H
CRC-16		Low	4FH
		High	77H

PLC→PC(ERROR)

Slave Address		01H
Function Code		85H
Exception Code		02H
CRC-16	Low	C2H
	High	94H

Remark	A value of 0xFF00 requests the coil to be ON. A value of 0x0000 requests the coil to be OFF.

C. 0FH Write multiple coils:

Function Code	0FH
Function	This function code is used to force each coil in a sequence of coils (from 1 to 1968) to either ON or OFF in a remote device.

Format

PC → PLC

Slave Address			11 H
Function Code			0FH
Data	Start Address	High	00H
		Low	13H
	Coil number	High	00H
		Low	0AH
	Bytes		02H
	*Input Data		
CRC-16		Low	XX
		High	XX

PLC→PC(OK)

Slave Address			01H
Function Code			0FH
Data	Check Code	High	00H
		Low	13H
	Data		00H
		Low	0AH
CRC-16		Low	26H
		High	99H

PLC→PC(ERROR)

Slave Address		01H
Function Code		8FH
Exception Code		01H
CRC-16	Low	84H
	High	35H

Remark

1. Byte count equals quantity of coils / 8, if the remainder is different of 0, add one.
2. The data length is equal to Bytes. As in the above example, Bytes=2, that is input data length is 2 bytes.
3. XX represents that the data differs with different input data
4. It is recommended to set the start address equal multiple of 8. It can improve the program efficiency.

D. 03H read register:

<table>
<tr><td>Function Code</td><td>03H</td></tr>
<tr><td>Function</td><td>This function code is used to read the contents of from 1 to 125 consecutive blocks of holding registers in a remote device.</td></tr>
<tr><td>Format</td><td>
PC → PLC
<table>
<tr><td colspan="3">Slave Address</td><td>01H</td></tr>
<tr><td colspan="3">Function Code</td><td>03H</td></tr>
<tr><td rowspan="4">Data</td><td rowspan="2">Start Address</td><td>High</td><td>40H</td></tr>
<tr><td>Low</td><td>6BH</td></tr>
<tr><td rowspan="2">Register number</td><td>High</td><td>00H</td></tr>
<tr><td>Low</td><td>03H</td></tr>
<tr><td colspan="2" rowspan="2">CRC-16</td><td>Low</td><td>63H</td></tr>
<tr><td>High</td><td>47H</td></tr>
</table>
PLC→PC(OK)
<table>
<tr><td colspan="2">Slave Address</td><td>01H</td></tr>
<tr><td colspan="2">Function Code</td><td>03H</td></tr>
<tr><td colspan="2">Bytes</td><td>06H</td></tr>
<tr><td colspan="3">*Responding Data</td></tr>
<tr><td rowspan="2">CRC-16</td><td>Low</td><td>XX</td></tr>
<tr><td>High</td><td>XX</td></tr>
</table>
PLC→PC(ERROR)
<table>
<tr><td colspan="2">Slave Address</td><td>01H</td></tr>
<tr><td colspan="2">Function Code</td><td>83H</td></tr>
<tr><td colspan="2">Exception Code</td><td>02H</td></tr>
<tr><td rowspan="2">CRC-16</td><td>Low</td><td>C1H</td></tr>
<tr><td>High</td><td>34H</td></tr>
</table>
</td></tr>
<tr><td>Remark</td><td>
1. Start character is the first register address.
2. Byte count equals quantity of register ×2. Data length is byte count. For each register, each word contains a high byte and a low byte.
3. The data length is equal to Bytes. As in the above example, Bytes=6, that is input data length is 6 bytes.
4. It is recommended to set the start address equal multiple of 8. It can improve the program efficiency.
5. XX represents that the data differs with different input data
</td></tr>
</table>

E. 06H Write a single register

<table>
<tr><td>Function Code</td><td>06H</td></tr>
<tr><td>Function</td><td>This function code is used to write a single holding register in a remote device.</td></tr>
<tr><td>Format</td><td>
<table>
<tr><th colspan="4">PC → PLC</th></tr>
<tr><td colspan="3">Slave Address</td><td>01H</td></tr>
<tr><td colspan="3">Function Code</td><td>06H</td></tr>
<tr><td rowspan="4">Data</td><td>40H</td><td>High</td><td>40H</td></tr>
<tr><td>01H</td><td>Low</td><td>01H</td></tr>
<tr><td>00H</td><td>High</td><td>00H</td></tr>
<tr><td>03H</td><td>Low</td><td>03H</td></tr>
<tr><td colspan="2" rowspan="2">CRC-16</td><td>Low</td><td>8DH</td></tr>
<tr><td>High</td><td>CBH</td></tr>
</table>
<table>
<tr><th colspan="4">PLC→PC(OK)</th></tr>
<tr><td colspan="3">Slave Address</td><td>01H</td></tr>
<tr><td colspan="3">Function Code</td><td>06H</td></tr>
<tr><td rowspan="4">Data</td><td rowspan="2">Register address</td><td>High</td><td>40H</td></tr>
<tr><td>Low</td><td>01H</td></tr>
<tr><td rowspan="2">Input Data</td><td>High</td><td>00H</td></tr>
<tr><td>Low</td><td>03H</td></tr>
<tr><td colspan="2" rowspan="2">CRC-16</td><td>Low</td><td>8DH</td></tr>
<tr><td>High</td><td>CBH</td></tr>
</table>
<table>
<tr><th colspan="3">PLC→PC(ERROR)</th></tr>
<tr><td colspan="2">Slave Address</td><td>01H</td></tr>
<tr><td colspan="2">Function Code</td><td>86H</td></tr>
<tr><td colspan="2">Exception Code</td><td>03H</td></tr>
<tr><td rowspan="2">CRC-16</td><td>Low</td><td>02H</td></tr>
<tr><td>High</td><td>61H</td></tr>
</table>
</td></tr>
<tr><td>Remark</td><td></td></tr>
</table>

F. 10H Write multiple registers:

<table>
<tr><td>Function Code</td><td>10H</td></tr>
<tr><td>Function</td><td>This function code is used to write a block of consecutive registers (1 to 125 registers) in a remote device.</td></tr>
<tr><td>Format</td><td>
<table>
<tr><th colspan="4">PC → PLC</th></tr>
<tr><td colspan="3">Slave Address</td><td>01H</td></tr>
<tr><td colspan="3">Function Code</td><td>10H</td></tr>
<tr><td rowspan="6">Data</td><td rowspan="2">Start Address</td><td>High</td><td>40H</td></tr>
<tr><td>Low</td><td>01H</td></tr>
<tr><td rowspan="2">Register number</td><td>High</td><td>00H</td></tr>
<tr><td>Low</td><td>02H</td></tr>
<tr><td colspan="2">Bytes count</td><td>04H</td></tr>
<tr><td colspan="3">*Input Data</td></tr>
<tr><td colspan="2" rowspan="2">CRC-16</td><td>Low</td><td>XX</td></tr>
<tr><td>High</td><td>XX</td></tr>
</table>
<table>
<tr><th colspan="4">PLC→PC(OK)</th></tr>
<tr><td colspan="3">Slave Address</td><td>01H</td></tr>
<tr><td colspan="3">Function Code</td><td>10H</td></tr>
<tr><td rowspan="4">Data</td><td rowspan="2">Start Address</td><td>High</td><td>40H</td></tr>
<tr><td>Low</td><td>01H</td></tr>
<tr><td rowspan="2">Register number</td><td>High</td><td>00H</td></tr>
<tr><td>Low</td><td>02H</td></tr>
<tr><td colspan="2" rowspan="2">CRC-16</td><td>Low</td><td>05H</td></tr>
<tr><td>High</td><td>C8H</td></tr>
</table>
<table>
<tr><th colspan="3">PLC→PC(ERROR)</th></tr>
<tr><td colspan="2">Slave Address</td><td>01H</td></tr>
<tr><td colspan="2">Function Code</td><td>90H</td></tr>
<tr><td colspan="2">Exception Code</td><td>03H</td></tr>
<tr><td rowspan="2">CRC-16</td><td>Low</td><td>0CH</td></tr>
<tr><td>High</td><td>01H</td></tr>
</table>
</td></tr>
<tr><td>Remark</td><td>1. Start character is the first register address.
2. Byte count equals quantity of register ×2. (each register contains two bytes)
3. The data length is equal to Bytes. As in the above example, Bytes=4, that is input data length is 4 bytes.
4. XX represents that the data differs with different input data.</td></tr>
</table>

G. 08H Diagnose:

The function code 08 provides a series of tests for checking the communication system between a client (Master) device and a server (Slave), or for checking various internal error conditions within a server.

Sub-function 00: Return Query Data

<table>
<tr><td>Function Code</td><td>Sub-function 0000</td></tr>
<tr><td>Function</td><td>Return Query Data</td></tr>
<tr><td>Format</td><td>
<table>
<tr><th colspan="4">PC → PLC</th></tr>
<tr><td colspan="3">Slave Address</td><td>01H</td></tr>
<tr><td colspan="3">Function Code</td><td>08H</td></tr>
<tr><td rowspan="4">Data</td><td rowspan="2">Sub-function</td><td>High</td><td>00H</td></tr>
<tr><td>Low</td><td>00H</td></tr>
<tr><td rowspan="2">Data</td><td>High</td><td>A5H</td></tr>
<tr><td>Low</td><td>37H</td></tr>
<tr><td colspan="2" rowspan="2">CRC-16</td><td>Low</td><td>DAH</td></tr>
<tr><td>High</td><td>8DH</td></tr>
</table>
<table>
<tr><th colspan="4">PLC→PC(OK)</th></tr>
<tr><td colspan="3">Slave Address</td><td>01H</td></tr>
<tr><td colspan="3">Function Code</td><td>08H</td></tr>
<tr><td rowspan="4">Data</td><td rowspan="2">Sub-function</td><td>High</td><td>00H</td></tr>
<tr><td>Low</td><td>00H</td></tr>
<tr><td rowspan="2">Data</td><td>High</td><td>A5H</td></tr>
<tr><td>Low</td><td>37H</td></tr>
<tr><td colspan="2" rowspan="2">CRC-16</td><td>Low</td><td>DAH</td></tr>
<tr><td>High</td><td>8DH</td></tr>
</table>
<table>
<tr><th colspan="3">PLC→PC(ERROR)</th></tr>
<tr><td colspan="2">Slave Address</td><td>01H</td></tr>
<tr><td colspan="2">Function Code</td><td>88H</td></tr>
<tr><td colspan="2">Exception Code</td><td>02H</td></tr>
<tr><td rowspan="2">CRC-16</td><td>High</td><td>C7H</td></tr>
<tr><td>Low</td><td>C1H</td></tr>
</table>
</td></tr>
<tr><td>Remark</td><td>Data is a random word.</td></tr>
</table>

H. 6CH : PLC control**(6CH: RUN/STOP program, Write ID and Read RUN/STOP state):**

a. Sub-function FF00: Control TP03 user program running/stopping

<table>
<tr><td>Function Code</td><td>Sub-function FF00</td></tr>
<tr><td>Function</td><td>Control TP03 user program running/stopping</td></tr>
<tr><td>Format</td><td>
<table>
<tr><th colspan="4">PC → PLC</th></tr>
<tr><td colspan="3">Slave Address</td><td>01H</td></tr>
<tr><td colspan="3">Function Code</td><td>6CH</td></tr>
<tr><td rowspan="4">Data</td><td rowspan="2">Sub-function</td><td>High</td><td>FFH</td></tr>
<tr><td>Low</td><td>00H</td></tr>
<tr><td rowspan="2">Data</td><td>High</td><td>53H</td></tr>
<tr><td>Low</td><td>54H</td></tr>
<tr><td colspan="2" rowspan="2">CRC-16</td><td>Low</td><td>9CH</td></tr>
<tr><td>High</td><td>D8H</td></tr>
</table>
<table>
<tr><th colspan="4">PLC→PC(OK)</th></tr>
<tr><td colspan="3">Slave Address</td><td>01H</td></tr>
<tr><td colspan="3">Function Code</td><td>6CH</td></tr>
<tr><td rowspan="4">Data</td><td rowspan="2">Sub-function</td><td>High</td><td>FFH</td></tr>
<tr><td>Low</td><td>00H</td></tr>
<tr><td rowspan="2">Data</td><td>High</td><td>53H</td></tr>
<tr><td>Low</td><td>54H</td></tr>
<tr><td colspan="2" rowspan="2">CRC-16</td><td>Low</td><td>9CH</td></tr>
<tr><td>High</td><td>D8H</td></tr>
</table>
<table>
<tr><th colspan="3">PLC→PC(ERROR)</th></tr>
<tr><td colspan="2">Slave Address</td><td>01H</td></tr>
<tr><td colspan="2">Function Code</td><td>ECH</td></tr>
<tr><td colspan="2">Exception Code</td><td>04H</td></tr>
<tr><td rowspan="2">CRC-16</td><td>Low</td><td>6DH</td></tr>
<tr><td>High</td><td>03H</td></tr>
</table>
</td></tr>
<tr><td>Remark</td><td>1. If Data =5255H, run program (ASCII code ‘RU’);
2. If Data =5354H, stop program (ASCII code ‘ST’).</td></tr>
</table>

b. Sub-function FF01: Write TP03 ID

Function Code	Sub-function FF01
Function	Write TP03 ID
Format	(see below)
Remark	1. To write new ID number to TP03, Data is new ID number (1 to approx. 255). And the high byte must be set to 0. 2. If the TP03 is initialized, the ID will be reset to 001. If you want to set up a net, it is necessary to set a new ID for each PLC.

Format — PC → PLC

Slave Address			01 H
Function Code			6CH
Data	Sub-function	High	FFH
		Low	01H
	Data	High	00H
		Low	37H
CRC-16		Low	B3H
		High	51H

Format — PLC → PC(OK)

Slave Address			01H
Function Code			6CH
Data	Sub-function	High	FFH
		Low	01H
	Data	High	00H
		Low	37H
CRC-16		Low	B3H
		High	51H

Format — PLC → PC(ERROR)

Slave Address		01H
Function Code		ECH
Exception Code		04H
CRC-16	Low	6CH
	High	C6H

c. Sub-function FF02: Read TP03 running/stopping status

Function Code	Sub-function FF02
Function	Read TP03 running/stopping status
Format	(see below)
Remark	*: Sub-function: Read program running or stopping status, If return data =5255H, program running (ASCII code ‘RU’); if return data =5354H, program stopping (ASCII code ‘ST’).

Format — PC → PLC

Slave Address			01 H
Function Code			6CH
Data	Sub-function	High	FFH
		Low	02H
	Data	High	00H
		Low	00H
CRC-16		Low	00H
		High	17H

Format — PLC → PC(OK)

Slave Address			01H
Function Code			6CH
Data	Sub-function	High	FFH
		Low	02H
	Data	High	52H
		Low	55H
CRC-16		Low	FDH
		High	48H

Format — PLC → PC(ERROR)

Slave Address		01H
Function Code		ECH
Exception Code		04H
CRC-16	Low	6DH
	High	03H

d. Sub-function FF03: Set RTC value

<table>
<tr><td>Function Code</td><td>Sub-function FF03</td></tr>
<tr><td>Function</td><td>Set RTC value</td></tr>
<tr><td>Format</td><td>
PC → PC
<table>
<tr><td colspan="3">Slave Address</td><td>01 H</td></tr>
<tr><td colspan="3">Function Code</td><td>6CH</td></tr>
<tr><td rowspan="10">Data</td><td rowspan="2">Sub-function</td><td>High</td><td>FFH</td></tr>
<tr><td>Low</td><td>03H</td></tr>
<tr><td rowspan="2">Data</td><td>High</td><td>Sec</td></tr>
<tr><td>Low</td><td>Min</td></tr>
<tr><td rowspan="2">Data</td><td>High</td><td>Hou</td></tr>
<tr><td>Low</td><td>day</td></tr>
<tr><td rowspan="2">Data</td><td>High</td><td>Mon</td></tr>
<tr><td>Low</td><td>Yea</td></tr>
<tr><td rowspan="2">Data</td><td>High</td><td>Wee</td></tr>
<tr><td>Low</td><td>00</td></tr>
<tr><td colspan="2" rowspan="2">CRC-16</td><td>Low</td><td>XX</td></tr>
<tr><td>High</td><td>XX</td></tr>
</table>
PLC→PC(OK)
<table>
<tr><td colspan="3">Slave Address</td><td>01H</td></tr>
<tr><td colspan="3">Function Code</td><td>6CH</td></tr>
<tr><td rowspan="2">Data</td><td rowspan="2">Sub-function</td><td>High</td><td>FFH</td></tr>
<tr><td>Low</td><td>03H</td></tr>
<tr><td colspan="2" rowspan="2">CRC-16</td><td>Low</td><td>C4H</td></tr>
<tr><td>High</td><td>F4H</td></tr>
</table>
PLC→PC(ERROR)
<table>
<tr><td colspan="2">Slave Address</td><td>01H</td></tr>
<tr><td colspan="2">Function Code</td><td>ECH</td></tr>
<tr><td colspan="2">Exception Code</td><td>04H</td></tr>
<tr><td rowspan="2">CRC-16</td><td>Low</td><td>6CH</td></tr>
<tr><td>High</td><td>C6H</td></tr>
</table>
</td></tr>
<tr><td>Remark</td><td>1. Data length is 8 bytes, BCD code (second, minute, hour, day, month, year, week, 00).
2. XX represents that the data differs with different input data</td></tr>
</table>

I. 01H Read TP03 ID

<table>
<tr><td>Function Code</td><td>01H</td></tr>
<tr><td>Function</td><td>Read TP03 ID</td></tr>
<tr><td>Format</td><td>
PC → PLC
<table>
<tr><td colspan="2">Slave Address</td><td>01 H</td></tr>
<tr><td colspan="2">Function Code</td><td>01H</td></tr>
<tr><td rowspan="2">CRC-16</td><td>Low</td><td>C0H</td></tr>
<tr><td>High</td><td>2CH</td></tr>
</table>
PLC→PC(OK)
<table>
<tr><td colspan="2">Slave Address</td><td>01H</td></tr>
<tr><td colspan="2">Function Code</td><td>01H</td></tr>
<tr><td rowspan="2">Data</td><td>Bytes</td><td>01H</td></tr>
<tr><td>TP03 ID</td><td>03H</td></tr>
<tr><td rowspan="2">CRC-16</td><td>Low</td><td>10H</td></tr>
<tr><td>High</td><td>4CH</td></tr>
</table>
PLC→PC(ERROR)
<table>
<tr><td colspan="2">Slave Address</td><td>01H</td></tr>
<tr><td colspan="2">Function Code</td><td>91H</td></tr>
<tr><td colspan="2">Exception Code</td><td>04H</td></tr>
<tr><td rowspan="2">CRC-16</td><td>Low</td><td>4CH</td></tr>
<tr><td>High</td><td>53H</td></tr>
</table>
</td></tr>
<tr><td>Remark</td><td>1. Such function is available for one TP03 communicating with another one. If there is several TP03s in the net, the data in the bus must be wrong.
2. When in reading TP03 ID, the slave address is the random number except 0. In responding, the slave address will be right ID.</td></tr>
</table>

3.3.2 Data link

TP03 master can communicate with as many as 15 TP03 slaves with the application instruction: DTLK. Here is the briefing about this function and as for more information, plese refer to Instruction Description F190 DTLK.

Item	Specification
Communication	EIA RS-485
Baud rate	300bps~307200bps
Slaves	Max 15 slaves
Connecting area	D0~D157, M2000~M3023
Data length for each slave	Max: 64bit+8 word
Cable	Isolated twist cable, 2-wire2 Total length: 500m(76800bit/s), 1km(38400bit/s)

Application instruction format

FUN: DTLK	K

K : set the port, range 0~1;
0: built-in RS485 port;
1: RS485/ RS232 expansion communication port

3.3.3 REMOTE I/O instruction

TP03 master can communicate with as many as 4 TP03 slaves with the application instruction RMIO. Here is the briefing about this function and as for more information, please refer to Instruction Description F191.

<table>
<tr><th>Item</th><th colspan="2">Description</th></tr>
<tr><td>communication</td><td colspan="2">EIA RS485 standard</td></tr>
<tr><td>Baud rate</td><td colspan="2">9600bps~614400bps</td></tr>
<tr><td>Slave</td><td colspan="2">Max 4 slaves</td></tr>
<tr><td rowspan="4">Remote I/O
(for master)</td><td>Slave 1</td><td>Input: 36 points (M4200~M4235);
output: 24 points (M4600~M4623)</td></tr>
<tr><td>Slave 2</td><td>Input: 36 points (M4240~M4275);
output: 24 points (M4624~M4647)</td></tr>
<tr><td>Slave 3</td><td>Input: 36 points (M4280~M4315);
output: 24 points (M4648~M4671)</td></tr>
<tr><td>Slave 4</td><td>Input: 36 points (M4320~M4355);
output: 24 points (M4672~M4695)</td></tr>
<tr><td>Cable</td><td colspan="2">Isolated twist cable, 2-wire2
Total length: 500m(76800bit/s), 1km(38400bit/s)</td></tr>
</table>

Note: Remote I/O slave should be TP03 basic unit rather expansion unit or other.

Application instruction:

F191: RMIO	K

K port selection, range :0~1.
0: built-in RS485 port.
1: RS485/ RS232 expansion communication port

Function description:

When TP03 is set to such mode, the input and output of master can be expanded. Max slave number is 4 in this configuration. The I/O of slave is just the expansive input and output for master and the program in slaver will not be operated.

3.3.4 RS/MBUS instruction

Here is the briefing about this function and as for more information, plese refer to Instruction Description F80 (RS) and F87 (MBUS).

Application Instruction

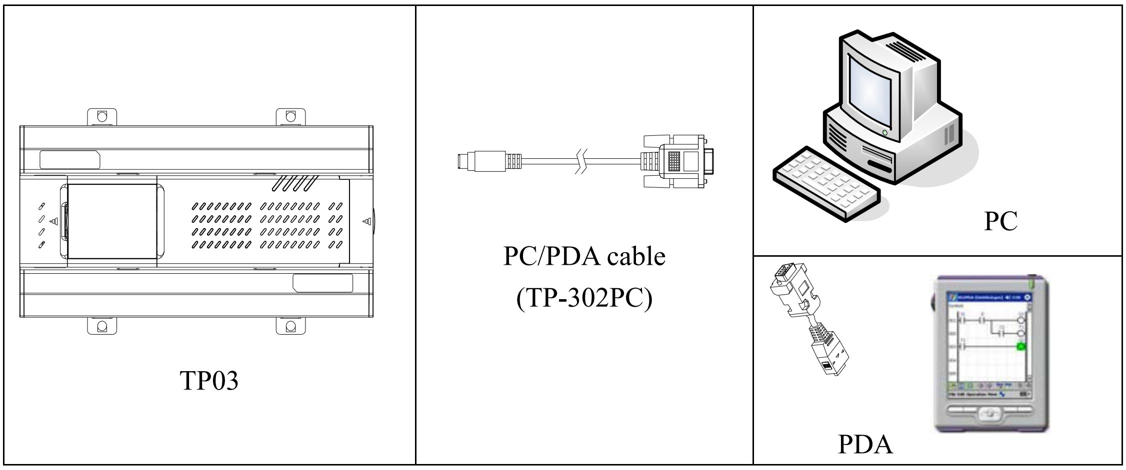
F80: RS	S	m	D	n	K
F87: MBUS	S	m	D	n	K

S: sending address
m: data length(0~255)
D: receiving address
n : receiving data length(0~255)
K: port selection, range: 0~1 . 0: RS485port,
1: RS485/ RS232 expansion communication port

- RS instruction needs no communication protocol. Data communication is available for other communication unit including PC, barcode reader and printer.
- MBUS instruction is for modbus master with RTU mode or ASCII mode.。

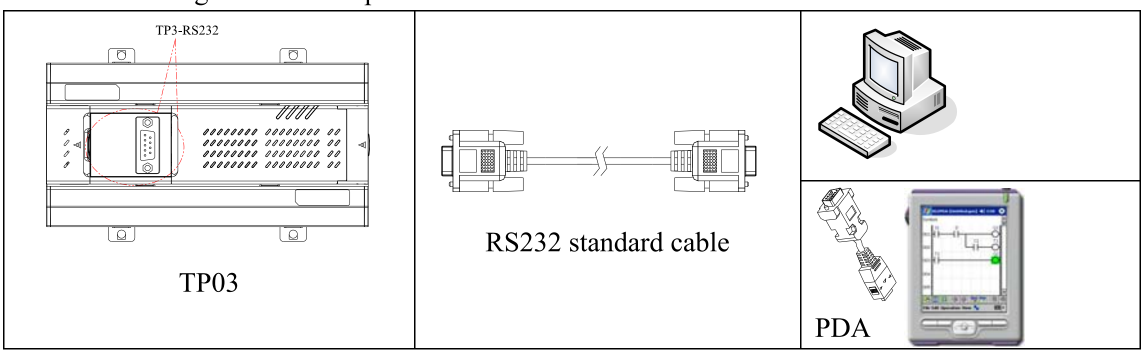
3.4 Wiring methods

A. Wiring for PC/PDA communication port



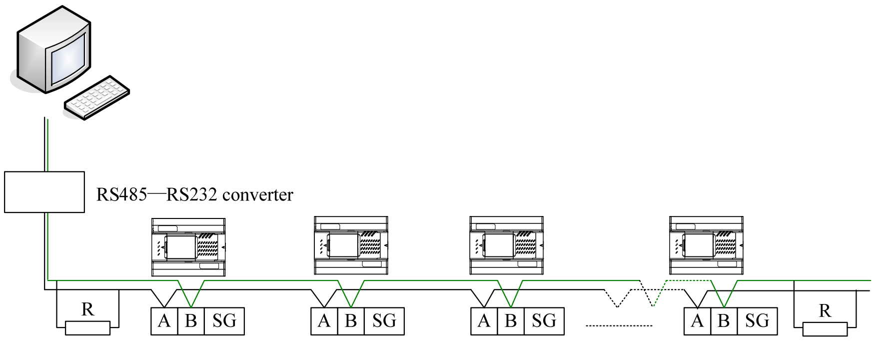
Note: User can mode the adapter that tranfers signal RS422 from 9 pin D-type connector to RS 485 on A/B terminal. Please refer to section 5 of Chapter 1 for more information about the TP-302PC Pins and its definition.

B. Wiring for RS232 expansion card

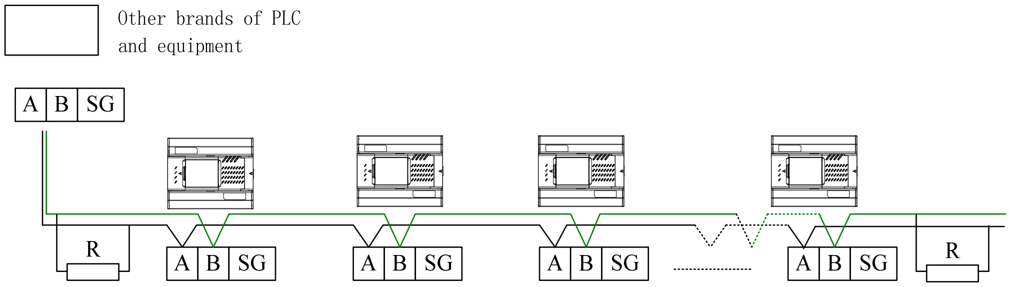


C. Wiring for built-in RS485 port or RS485 expansion card.

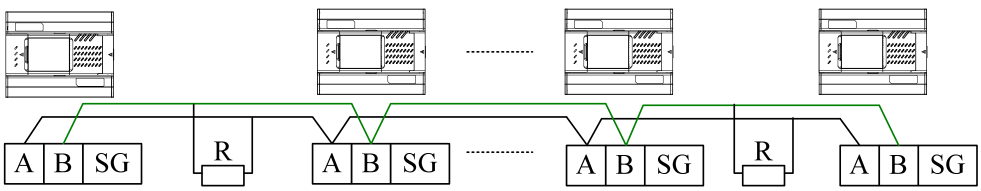
a. Linking with controller



Or

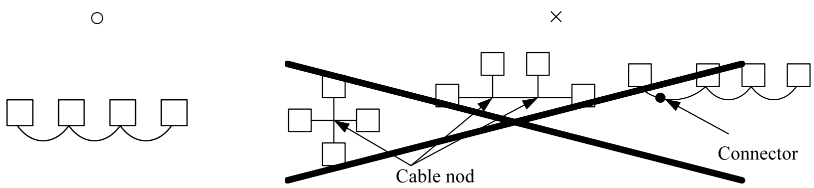


b. DATA LINK & REMOTE I/O communication.



Note 1: SHL terminal should be 3 class ground or the production will be interrupted to error operation because of noise.

Note 2: Branch of communication cable should not exceed 3.



Note 3: R represents terminal resistor (120Ω,1/4W).

4 High speed counter

4.1 General characteristic of high speed counter

Input requirements:

A. the duty circle for the input form should be 1:1;

B. Low voltage level should be less than 9V.

C. The respnding frequency of the high speed counter differs from high /low voltage level.

Input teminal		High voltage level	Frequencty									
			-14S	-20S	-26S	-36S	-20M	-30M	-20H	-30H	-40H	-60H
X000~X003	1 Phase	15v~20v	10 KHz						100 KHz			
	2 Phase	15v~28.8v	10 KHz						50 KHz			
X004~X005	1Phase/2 Phase	15v~28.8v	Unused				5 KHz		5 KHz			

The above requirement should be met, or the responding frequency will be less or the counting data would be wrong.

4.2 Number for Built-in high speed counter

The number is as following:

TP03M/H type

	1phase 1 input counting											1phase 2 inputs counting				2phases 2 inputs counting			
	C235	C236	C237	C238	C239	C240	C241	C242	C243	C244	C245	C246	C247	C248	C249	C251	C252	C253	C254
X000	U/D						U/D			U/D		U	U		U	A	A		A
X001		U/D					R			R		D	D		D	B	B		B
X002			U/D					U/D			U/D		R		R		R	A	R
X003				U/D				R			R			U				B	
X004					U/D				U/D	S				D				R	
X005						U/D			R		S			R	S				S
U: Up-counting							R: Reset									A: A Phase			
D: Down-counting							S: Set									B: B Phase			

C250 / C255 are reserved.

TP03SR type

	1phase 1 input counting											1phase 2 inputs counting				2phases 2 inputs counting			
	C235	C236	C237	C238			C241	C242				C246	C247			C251	C252	C253	
X000	U/D						U/D					U	U			A	A		
X001		U/D					R					D	D			B	B		
X002			U/D					U/D					R				R	A	
X003				U/D				R										B	
U: Up-counting							R: Reset									A: A Phase			
D: Down-counting																B: B Phase			

C239/C240/C243/C244/C245/C248/C249/C250/C254/C255 are reserved.

Reading the table:

◆ 1phase 1 input counting:

X000 input: corresponding to C235 (U/D) which has no interruption reset and set function

Or corresponding to C241 (U/D) which can be interruption reset by X001 and has no interruption set function.

Or corresponding to C244 (U/D) which can be interruption reset by X001 and interruption set by X004.

And the rest may be deduced by analogy.

◆ 1 phase 2 inputs counting :

X000 input: corresponding to C246 (U/D) Up counting, C246 Down counting defaults to X001, has no interruption reset and set function

Or corresponding to C249 (U/D) Up counting, C249 Down counting defaults to X001, interruption Reset to X002 and Set to X005.

And the rest may be deduced by analogy.

◆ 2 phases 2 inputs counting:

X000 input : corresponding to C251 (A/B) A phase counting, C246 B phase counting defaults to X001, has no interruption reset and set function

corresponding to C254 (A/B) A phase counting, C254 B phase counting defaults to X001, interruption Reset to X002 and Set to X005.

And the rest may be deduced by analogy.

Note: With regard to high speed counting, the number of the counter should be input X000~X005 which can not be repeatedly used. As for NON-high-speed-counting, the input X000~X005, as other input, could be the general input relay in sequential program. Furthermore, the soft device of high speed counting, if not executing high speed counting, can also be define as 32-bit data register to saving digit.

If X000 is used in C235, it can not be used in C241, C244, C246, C247, C249, C251, C252, C254 and interruption pointerI00□ or M8170 pulse snapping.

4.3 Function

The high speed counter operates differently if the input is not same. Refer to the former table for fore information about the operation. The Set and Reset of the high speed counter, having nothing to do with PLC scan time, is controlled by interruption pointer.
Such counter (32bit, up counting/ down counting, HEX) can be classified into three types according to different switching of the up and down counting.

Item	1phase 1 input counting	1phase 2 inputs counting	2phases 2 inputs counting
Counting direction, up/down	C235~C245 counting direction is controlled by M8235~M8245 ON /OFF.	Automatically controlled by the different inputs.	A phase is ON, and at the same time, B phase is OFF—ON: up counting; B phase is ON—OFF: down counting.
Supervision counting direction	——	Supervise M8246~M8255 to show counting direction.	

In terms of all kinds of high speed counter, the reset and set is controlled by interruption pointer.

Information on M8xxx controlling counting direction

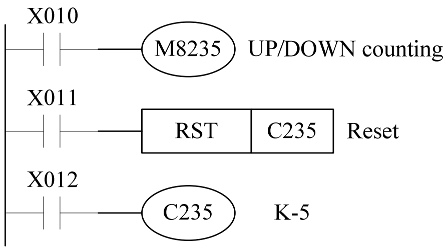
Type	Counter	M8xxx relay	
1phase 1input	C235	M8235	ON : operating DOWN counting (DN) OFF: operating UP counting (UP)
	C236	M8236	
	C237	M8237	
	C238	M8238	
	C239	M8239	
	C240	M8240	
	C241	M8241	
	C242	M8242	
	C243	M8243	
	C244	M8244	
	C245	M8245	

Information on M8xxx supervising counting direction

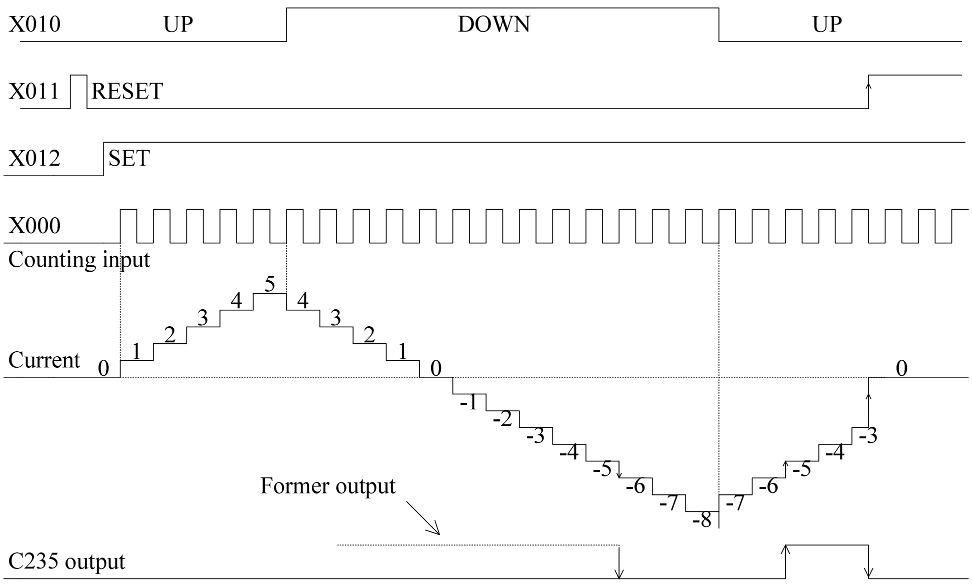
Type	Counter	M8xxx relay	
1phase 2input	C246	M8246	ON : indicating DOWN counting (DN) OFF: indicating UP counting (UP)
	C247	M8247	
	C248	M8248	
	C249	M8249	
2phase 2input	C251	M8251	
	C252	M8252	
	C253	M8253	
	C254	M8254	

4.4 Application example for 1 phase high speed counter

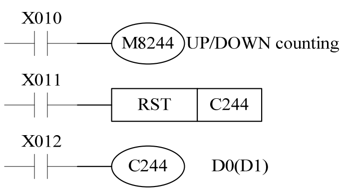
4.4.1 1 Phase 1 input



- ◆ X010 OFF: up counting; X010 OFF: Down counting
- ◆ If X011 is enabled, C235 will be reset (RST).
- ◆ When X012 is ON, C235 will count input X000.

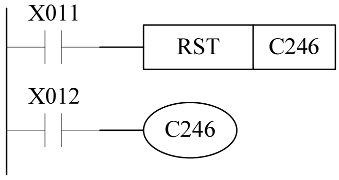


- ● X010 controls C235 up/down counting.
- ● When the present value changes from -6 to -5, the output of C235 will be ON. While as the present value changes from -5 to -6, the output of C235 will be OFF.
- ● The output action has not relation to present value. The value 2,147,483,647 will change to -2,147,483,648 as up counting is operated, also, the value -2,147,483,648will change to 2,147,483,647 as down counting is operated.
- ● When X011 is enabled, the instruction RST will be operated, namely, the current value will be cleared to 0 and output will be OFF.
- ● As for the retentive high speed counter, the present value and output state (ON/OFF) will be kept as power fails.

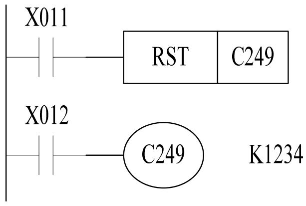


- ◆ When X012 is ON, and input X004 is also ON, C244 starts to count X000 pulse. In the example, the set value can be data in index register (D1, D0).
- ◆ When X001 is ON, C244 will be set at once. However, such reset action also can be accomplished by sequential instruction RST, as above figure.
- ◆ M8235~M8245 ON / OFF can control C235~C245 counting direction.

4.4.2 1 Phase 2 input



◆ X012 is ON: C246 will operate up counting when Input X000 is OFF→ON, while Down counting when X001 is OFF→ON.



◆ X012 is ON: C249 will start to operate up counting for X001, down counting for X000 when X005 is ON.

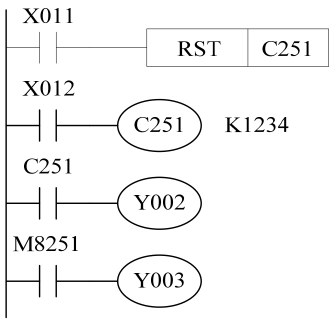
◆ When X002 is ON, C249 will be reset at once. Sequential instruction RST also can do the same as left figure.

◆ C246~C249 counting direction can be supervised by M8235~M8245.

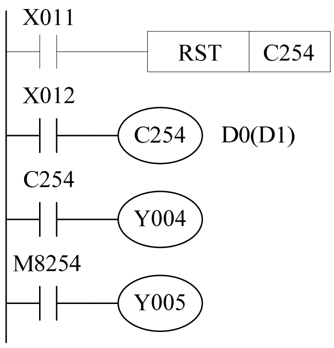
4.5 Application example for 2 phase high speed counter

4.5.1 2 Phase 2 inputs

The present value and output operation of 32 bit counter is same with former 1phase 1input high speed counting.



- When X012 ON, C251 starts to count X000 (A phase), and X001(B phase). When X011 ON, RST instruction reset C251.
- If the present value is bigger than set value, Y000ON, and if not, Y002 OFF.
- When Y003 ON, counting direction is Up, or the direction is Down.



- When X012 ON and X006 ON, C254 starts to count X000 (A phase) and X001 (B phase).
- When X011 ON, reset C254. And X002 also can do that.
- If the present value is bigger than set value, Y004 ON. Otherwise, Y004 will be OFF.
- Y005 ON: Down counting; Y005 OFF: Up counting.
- When A phase is ON and B phase is change OFF to ON, the counting direction will be UP. Otherwise, when B is change ON to OFF, direction will be down. The state ON/OFF of M8251~M8255 can indicate the counting direction of C251~C255.

4.5.2 Action of 2 phase input signal

- 2 phase encoder can produce A phase and B phase with 90° phase difference to A phase. Such high speed counter can automatically up count or down count.
- The following indicates operation of 2 phase counter.

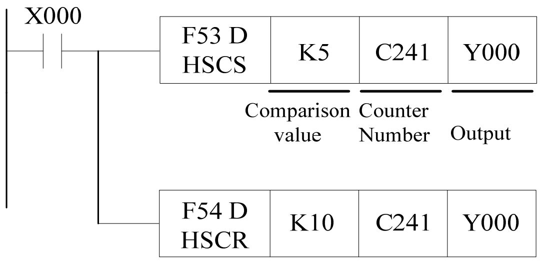


Forward: up counting　　　　Reverser: down counting

4.6 Output counting result

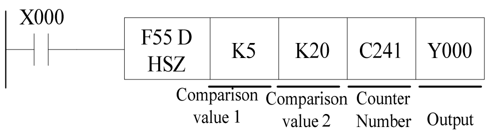
The output should be enabled immediately as long as the present value reaches the set value of high speed counter, so the special application instructions should be used.

A. <<Comparison set/reset instruction for high speed counter>>



- When reaching the comparison value, the interruption will be on (Y000 ON).
- Please select transistor output type. As for relay output type, the PLC has a mechanical delay about 10ms.

B. <<Zone comparison instruction for high speed counter>>



- Zone comparison instruction of high-speed

K10＞C241 present value →Y000 ON
K10＜C241 present value＜K20 →Y001 ON
C241 present value＞K20 →Y002 ON

Regarding to general application instruction F10 (CMP) and FNC11 (ZCP), there will be a delay because of PLC scan time. In order to avoid that delay in high speed counting, the above instructions F53, F54 and F55 have nothing to do with scan time and the output will operate immediately.

4.7 Restrictions for fastest responding frequency

Regarding to hardware, the input X000~X005 has the competence to accept 100 kHz signal. However, with respect to software, please take the following items into consideration:

A. When C235～C238,C241,C242,C244,C245 are set as up-counting counter, its max frequency could be 100KHz.

B. When C235～C238,C241,C242,C244,C245 are set as up/down counting counters or as down-counting ones, its max frequency could be 5KHz.

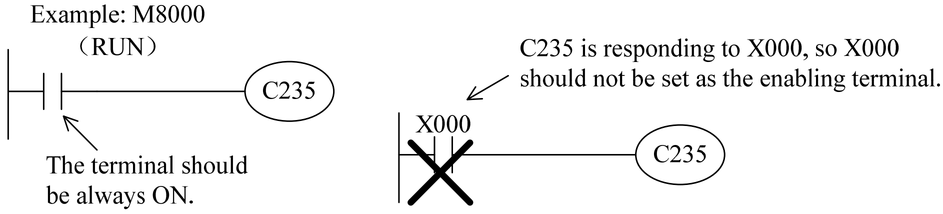
C. The C239～C240,C243,C246~C249 counters could accept the max frequency, 5KHz

D. The C251～C254 counters could accept the max frequency 100KHz.

E. When the system is preoccupied by a lot of other functions (such as frequent communication/ longer program/longer scan time/ many interruptions/ pulse output/ compare instruction for high speed counter), it is suggest that the max average frequency of high speed counter should be decreased properly.

4.8 Common consideration:

- The enabling terminal for high speed counters should be always ON.



- It is recommended to use contact without mechanical delay for high speed counter enabling device.The vibration of the analog switch would result in high speed counting error. Thusly, the analog switch can not be used as an enable device for high speed counter.
- The enabling relay for high speed counter can not be shared with other instructions.
  For instance: input interruption pointer and F56 SPD speed detect.
- Even the present value equal set value of high speed counter, the output will not be ON until it received counting pulse.
- The ON and OFF the enabling input for the high speed counter can control such counter RUN or STOP, which should be programmed in the main program. If it is in the SFC, Sub rountin or interruption program, Counter will not RUN or STOP till the SFC or Sub-Routin is operated.

5 Interruption Input

The input X000~X005 can be set to do interruption.

Basic specification

Type / Item	-14S	-20S	-26S	-36S	-20M	-30M	-20H	-30H	-40H	-60H
Input	X000~X003				X000~X005					
Pulse width	50us min.						5us min.			

Interruption definition:

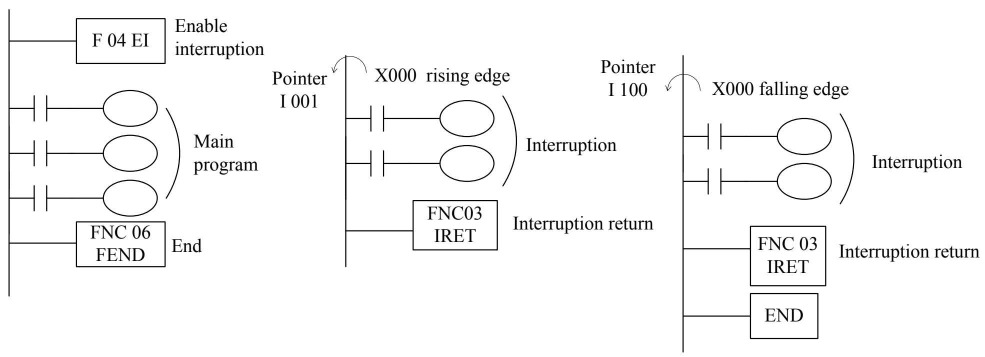
I x 0 x

- 0: Falling edge interruption   1: Rising edge interruption
- 0~5: X000~X005

Input	Interruption pointer		Forbid Interruption	Pulse Snap
	Rising edge interruption	Falling edge interruption		
X000	I001	I000	M8050	M8170
X001	I101	I100	M8051	M8171
X002	I201	I200	M8052	M8172
X003	I301	I300	M8053	M8173
X004	I401	I400	M8054	M8174
X005	I501	I500	M8055	M8175

- The pointer number can not be used repeatedly.
  As for the same input, the corresponding rising edge interruption and falling edge interruption can not be used in a same program.
- M8050~M8055 "ON" to ban corresponding input interruption.
  When X000~X005 generates a pulse, the corresponding relay will be set immediately.

Basic program for interruption



Please refer to Application Instruction F04 for programming information.

6 Pulse output

Basic specification

Type / Item	-20MT	-30MT	-20HT	-30HT	-40HT	-60HT
Pulse output	2 Points Y0/Y1 with acceleration/deceleration, without interpolation					
PWM output	2 Points Y0/Y					
Frequency	1KHz max.		100KHz max.			
Voltage range	12 ~ 24VDC					
Current range	10 mA ~ 300mA					
Output type	NPN Transistor					
Application instruction (refer to Instruction Description)	1. F57 PLSY : Pulse output Y 2. F58 PWM : Pulse Width Modulation 3. F59 PLSR : Pulse output with acceleration/deceleration 4. Position instruction: F156 – F159					
Remark:			The COM teminal for Y000/Y001 is internally connected with the terminal 0V for output 24VDC.			

Note: Such function should be done by above application instructions, and only transistor-output type is available. If relay-output type is set such function, the output will be error for the longer responding time 1 kHz. The lifespan of the relay would be shortened extremely. When Y0 is set for pulse output, X2 can not be set for high speed counter. While When Y1 is set for pulse output, X3 can not be set for high speed counter. While

As for the M type, the output should be wrong when the output frequency exceeds specified one.

7 Expansion card

- Only one expansion card is available for each basic unit.
- TP-0CV (built-in standard type) should be installed when TP03 has no expansion card to avoid dust accumulating and undermine connector function.
- Plug and unplug the card when power is OFF.
- As for more information, please refer to peripheral manual.

8 Built-in memory and memory card (TP03-1ME)

◆ Built-in memory

<table>
<tr><th colspan="2">Type</th><th>Saving content</th><th>Saving place</th></tr>
<tr><td colspan="2" rowspan="2">Memory for program</td><td>1. User program (20/30 type: 0~8K, 40/60type: 0~16K)
2. File register (D2000~D7999, 6K)
In total: 16K</td><td rowspan="2">Built-in flash memory (power fail have no impact on the data)</td></tr>
<tr><td>3. Remark (0~16K)
System specification (0~20)</td></tr>
<tr><td rowspan="2">Data register</td><td>Non-retentive</td><td>1. Input relay X, output relay Y, general auxiliary relay M, general state S
2. Timer contact and timing coil.
3. General counter contact, counting coil and reset coil.
4. General data register for present value.
5. Register for present value of timer.
6. Register for present value of general counter.</td><td>Built-in RAM (data will be lost as power fails)</td></tr>
<tr><td>retentive</td><td>1. Retentive auxiliary relay M, retentive state S.
2. Contact and coil of accumulating timer T.
3. Contact, counting coil and reset coil of retentive counter and high speed counter.
4. Retentive register D for present value
5. Register for present value of accumulating and 1ms timer T.
6. Register for present value of retentive counter and high speed counter.
7. Special register (M8000~M8511, D8000~D8511)</td><td>Built-in RAM (data will be saved by lithium battery as power fails)</td></tr>
</table>

◆ Memory card (TP3-1ME)

<table>
<tr><th>Type</th><th>Saving content</th><th>Saving place</th></tr>
<tr><td rowspan="2">Memory for program</td><td>1.User program (20/30 type: 0~8K, 40/60type: 0~16K)
2. Remark (0~16K)
In total: 16K</td><td rowspan="2">Built-in flash memory</td></tr>
<tr><td>3. file register (D2000~D7999,6K)
4. System specification (0~20)</td></tr>
<tr><td></td><td>5. Special register (M8000~M8511, D8000~D8511)</td><td></td></tr>
</table>

Note:

A. The program in built-in memory will be performed as memory card (TP3-1ME) is not used.
B. The memory card (TP3-1ME) is pluggable as power is off.
C. When power is ON, the program will be automatically transmitted from memory card (TP3-1ME) to built-in memory.
D. Software TP3-PC or TP3-PDA can read the data in built-in memory or memory card (TP3-1ME).

9 Password

Password set through TP3-PC or TP3-PDA can prevent the program from illegal upload or download. The password has 3 levels of protection with a letter 1, 2 or 3 in the head.

	Function	Setting	Description	
1	All is forbidden	1 □□□□□□□□	Forbid:	1. Read and writing in system memory; 2. Read and writing from/to Data register; 3. Supervision
2	Read and write from system memory is forbidden	2 □□□□□□□□	Forbid:	1. Read and writing in system memory;
			Allow:	1.Read and writing from /to Data register; 2. Supervision
3	Read from and write to from system memory is forbidden. And write to data register is forbidden	3 □□□□□□□□	Forbid:	1. Read and writing in system memory; 2. Writing to Data register;
			Allow:	1. Read from Data register; 2. Supervision
▯ represents: only for 1, 2 and 3. □ represents: the character among A-F or the number among 0-9 (any combinations are available).				

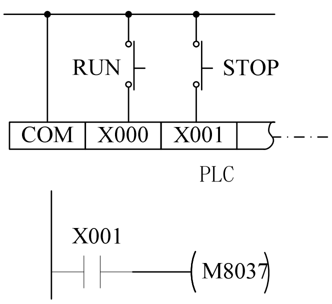
10 RUN/STOP switch

There are three modes to RUN/STOP TP03.

A. Send RUN/STOP command to TP03 through TP3-PC / TP3-PDA (refer to TP3-PC/TP3-PDA programming method for more information).

B. Built-in RUN/STOP switch
When the switch is turned to RUN position, TP03 will RUN, while it is turned to STOP, TP03 will stop. Such method is to enable RUN/STOP flag with rising edge.

C. Enforcing RUN/STOP through special auxiliary relays M8035～M8037



See the left figure. Please set M8035 to 1 and D8035 to 0. Then the switch for X000 and X001 can control the TP03 RUN or STOP.

a. Please set M8035 to 1 to enable external RUN/STOP mode.

b. To set D8035. Set one of the input points (X000~X007) as the RUN signal. When D8035 is set to 0 that represents X000, to 1 that represents X001. In this example, it is X000.

c. The pulse of the RUN signal from X000 or others can control TP03 to ‘RUN’. Which pulse of STOP signal from X001 or others can control TP03 to ‘STOP’. When both switches are turned ON, STOP has the priority.

Note:

◆ Whatever mode is set to control the TP03 RUN/STOP, M8036 will be set to 1, M8037 will be reset to 0 as TP03 is controlled to RUN, while M8036 will be reset to 0, M8037 will be set to 1 as TP03 is controlled to STOP.

◆ When RUN/STOP flag is set to ON simultaneously, TP03 will operate ‘STOP’ and reset M8036 (OFF).

11 RTC

Item \ Type	-20M	-30M	-20H	-30H	-40H	-60H
Register	N.A		Built-in: Second(D8013), Minute(D8014), Hour(D8015),Day(D8016), Month(D8017), Year(D8018), Week(D8019) With 30s offset			
Special application instruction (refer to the Instruction Description)	N.A		1. F160 TCMP: timing data compare 2. F161 TZCP: timing area data compare 3. F162 TADD: timing data add 4. F163 TSUB: timing data subtract 5. F166 TRD: read timing data 6. F167 TWR: write timing data 7. F169 HOUR: set the timer			
Tolerance	N.A		±45seconds/month (25℃)			
Leap year	N.A		Auto offset			
Flash memory retentive	N.A		D8013 – D8019 data will be kept by lithium battery when power fails			

Set the time for RTC through the special coils and registers

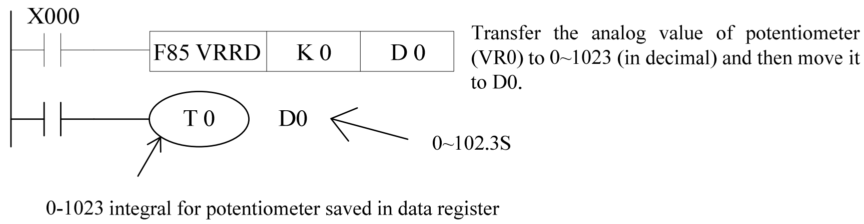
Special coil	Content	Description
M8015	Clock Stop and set	ON: timing stops and it can be reset
M8016	Stop time displaying	ON: Read/ display time is unavailable
M8017	±30s offset	ON: enable ±30s offset
M8018	Clock detection	ON: Clock is enabled
M8019	Clock error	ON: Clock error

Special register	Content
D8013	Second (0~59)
D8014	Minute (0~59)
D8015	Hour
D8016	Day
D8017	Month
D8018	Year (00~99)
D8019	Week

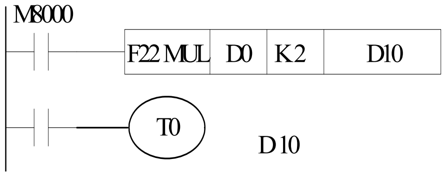
12 Potentiometer

TP03 has built-in standard analog potentiometer with corresponding data (0~1023) saved in hereinafter DATA register.

Such potentiometer could be set as the indirect set value for analog timer, which is called analog potentiometer timer.



As for the above example, the input value can be multified with the application instruction F22.



Transfer the data = [(data in D2) × 2] to D10(D11)

The multiplication instruction can expand the register data so the setting range will be widen. Max value should be below 32,767. In this example, D11 is automatically used by F22 MUL, do not use is at any other places.

- ◆ F86VRSC can read the value (0~10) for analog potentiometer with correspondent scale.
- ◆ There are 2 built-in analog potentiometers. If you prefer more, there is an optional card with 6 analog potentiometers.

13 Battery

Electric specification

Item	Description
Part number	BT-CR2450-CB-01
Voltage	3V
Capacity	600mA-HR
Lifespan	5 Year
Consideration	1. For use Do not charge the battery; do not short circuit the batter; use the battery only for the specified equipment; insert the battery in right polarity position; do not heat the batter; do not dispose of the batter in fire. 2. For transport and storage The handling of the packaged batteries must be adequate to avoid mechanical damage.Storage areas should be cool, dry, ventilated and protected from the rain and direct sunbeam.

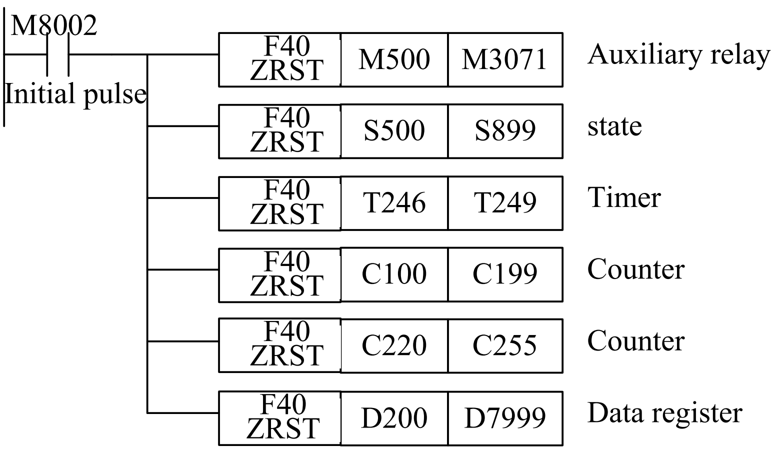
Run without battery (M8030 = ON).

When EPROM and EEPROM is only for saving program which has not retention requirement and RTC function, TP03 can Run at ‘without battery’ mode.

Although TP03 is set to ‘Run without battery’ mode, and the battery is not installed or has no power, the BAT LED will not be OFF.

Run without battery

Example for clearing program in memory backup area (parameter range is default as initial value)



Note: Generally, with respect to special data register D8120 (communication format), D8121 (address set) and D8129 (time out), all these registers are backup devices needing battery. If you require such function at ‘Run without battery’ mode, please reset all these registers firstly. Then, move the certain value to these register in the program.

14 Instruction

Please refer to chapter 7 for instruction set, or refer to Instruction description manual for more information on instructions.

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Chapter 3 Expansion unit specification

1 Digital expansion unit

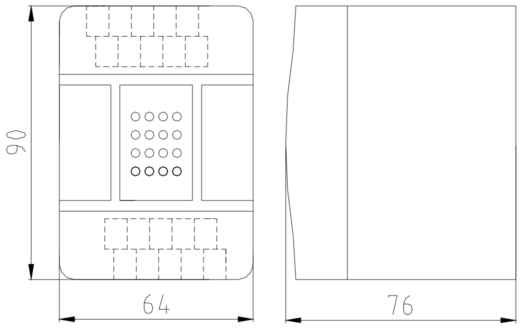
1.1 General specification

Type / Item	TP02 -16EXD	TP02 -16EYR	TP02 -16EYT	TP02 -16EMR	TP02 -32EMR	TP03 -16EMR	TP03 -16EMT	TP03 -16EYR	TP03 -16EYT	TP03 -16EXD
Expansion unit outline	Brick type									
Input point	16	0	0	8	16	8	8	0	0	16
Output point	0	16	16	8	16	8	8	16	16	0
Terminal block	Unremovable									
Dimension (WxHxD)	64 x 90 x 76mm				110 x 90 x 76 mm	57 x 90 x 83 mm				
Operation temperature	0 ~ 55℃ (32~131F)									
Storage temperature	-25 ~ +70℃									
Relative humidity	Level RH1，30~95% (non-condense)									
Pollution degree	2 (IEC 60664)									
Installation class	II									
Enclosure	IP20									
Anti-erosive	No erosive gas									
Altitude	Operation: 0 to 2,000m (0 to 6,565 feet) Transport:0 to 3,000m (0 to 9,840 feet)									
Vibration Resistance	Mounted on a DIN rail：10 to 57Hz amplitude 0.075mm, 57 to 150Hz acceleration 9.8m/sec^2 (1G) 2 hours per axis on each of three mutually perpendicular axis; Mounted on a panel surface：2 to 25Hz amplitude 1.6mm, 25 to 100Hz acceleration 39.2m/sec^2 (4G) Lloyd's 90 minutes per axis on each of three mutually perpendicular axis.									
Shock Resistance	147 m/sec2 (15G), 11 m sec duration, 3 shocks per axis, on three mutually perpendicular axis (IEC61131)									
Noise immunity	1,000Vpp，1us @30 to 100 Hz									
Dielectric withstand	1,500VAC > 1mins between all terminals to ground (for AC power supply)									
Dielectric withstand	500VAC > 1mins between all terminals to ground (for DC power supply)									
Insulation resistance	500V DC @> 10M ohm between all terminals to ground									
Grounding	100 ohm or less									

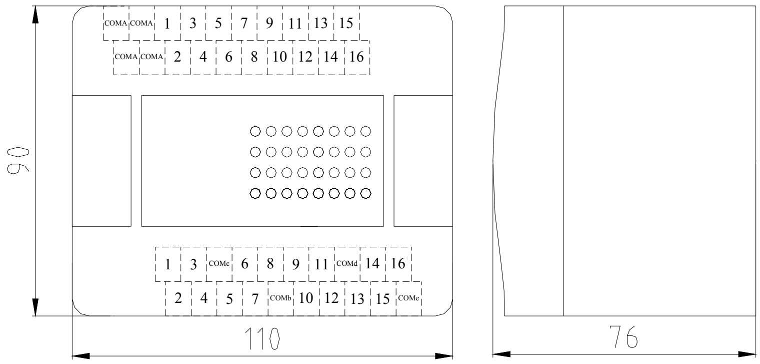
Chapter 3 Expansion unit specification

1.2 Outline dimension

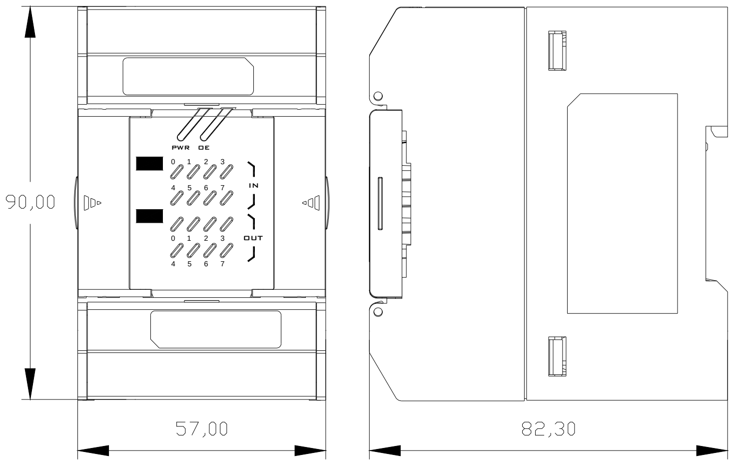
1.2.1 TP02 digital expansion unit I



1.2.2 TP02 digital expansion unit II

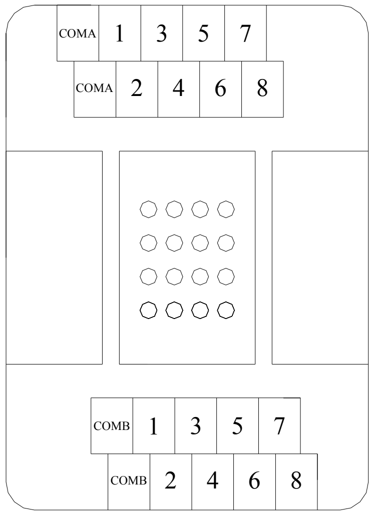


1.2.3 TP03 digital expansion unit



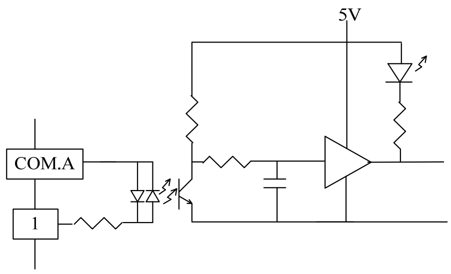
1.3 Electric specification

1.3.1 TP02-16EXD Specification

Item	specification	Outline figure
Input point	16	Upside terminal block  Downside terminal block
Output point	0	
Input voltage	DC24V +10%~-20%	
Input current	4.8mA @24VDC	
Input impedance	5 kΩ Typ.	
ON voltage/current level	> 20Vdc(3.5mA)	
OFF voltage/current level	< 8Vdc (1.5mA)	
Response time	10ms	
Input indicator	LED lit when input ON	
Insulation method	Photo-coupling insulation	
Internal power supply	5VDC:max current 50mA	
Accessory	Expansion cable(TP-042EC : 4cm，14pin)	

Terminal block	Symbol	content
	1 ~ 8	Input terminal
	COM.A~COM.B	Common terminal

Internal circuit



Note:

a. 8 inputs share one common terminal

b. The common terminals with same symbol in upside and downside are not connected internally.

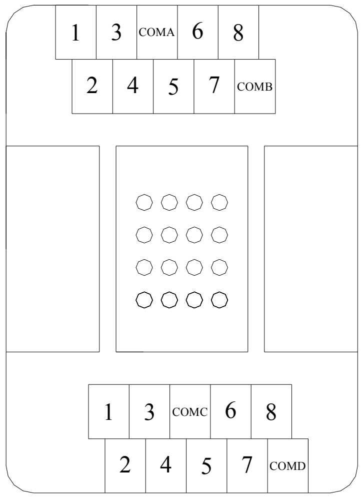
c. The last digit of TP03 I/O number should be start from 0(for instance, X000~X007, X010~X017, Y020~Y027 …) and allocated in octal. While the last digit of TP03 I/O number should be start from 1(The last digit of TP03 I/O number should be start from 0(for instance, X000~X007, X010~X017, Y020~Y027 …)and allocated in octal)and allocated in decimal. Consequently, when TP02 expansion module is expanded for TP03 basic unit, the number of I/O should be allocated according to such item.

1.3.2 TP02-16EYR Specification

Item		Specification
Input point		0
Output	Output point	16
	Voltage	AC250V/DC30V
	Current	2A/1 point ;5A/1common
	Type	Relay
	Mechanical lifespan	20,000,000 times
	Electric lifespan	150,000 times @ 3A
	Response time	Below 10ms
	Min load	1 mA @ 5vDC
	Indicator	LED LIT when output ON
	Insulation	Relay
Internal power supply: Consumption current		For 5VDC: max 50mA For 24VDC: max 80mA
Accessory		Expansion cable (TP-042EC : 4cm，14pin)

Outline figure

Upside terminal block



Downside terminal block

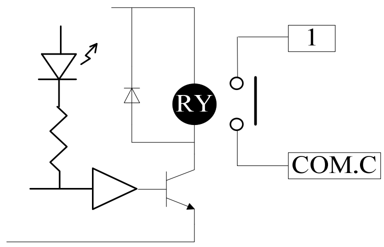
Terminal block	symbol	content
	1 ~ 8	Output terminal
	COM.A ~COM.D	Common terminal

Note:

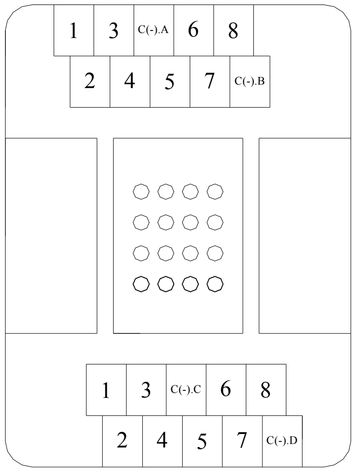
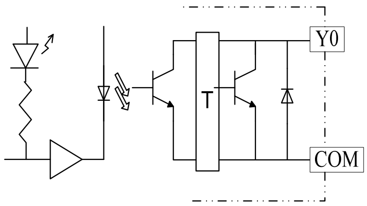
a. 4 points share one common terminal.

b. The common terminals with same symbol in upside and downside are not connected internally.

Internal circuit



1.3.3 TP02-16EYT specification

Item		Specification	Outline figure
Input point		0	Upside terminal block  Downside terminal block
Output	Output point	16	
	Voltage	DC4v～DC27V	
	Current	0.3A/1point; 1A/1 common	
	Type	Transistor NPN	
	Response time	Below 1ms	
	Output indicator	LED lit when output ON.	
	Insulation method	Photo-coupling insulation	
Internal power supply: Current consumption		For 5VDC: Max 50mA For 24VDC: Max 80mA	
accessory		Expansion cable (TP-042EC : 4cm，14pin)	
			Internal circuit
Terminal block	Symbol	content	
	1 ~ 8	Output terminal	
	C(-).A~C(-).D	Common terminal	
Note: a. 4 points share one common terminal. b. The common terminals with same symbol in upside and downside are not connected internally.			

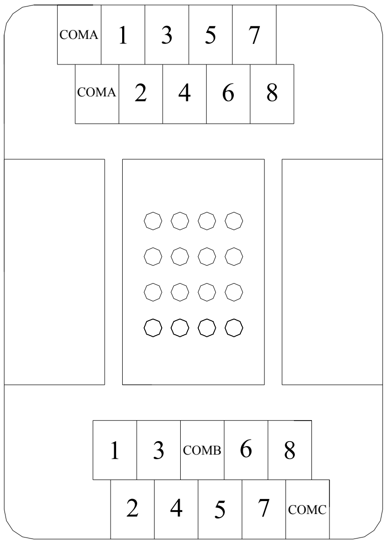
Chapter 3 Expansion unit specification

1.3.4 TP02-16EMR Specification

Item		Specification
Input point		8
Output point		8
Output	Voltage	AC250V/DC30V
	Current	2A/1 Point; 5A/1 common
	type	Relay
	Mechanical lifespan	20,000,000 times
	Electric lifespan	150,000 times @ 3A
	Responding time	Below 10ms
	Min load	1 mA @ 5vDC
	Output indicator	LED lit when output ON
	Insulation method	Relay
Input	Voltage	DC24V +10%～-20%
	Current	4.8mA @24VDC
	Impedance	5 kΩ Typ.
	ON level	Above 20Vdc (3.5mA) (min.)
	OFF level	Below 8Vdc (1.5mA) (max.)
	Responding time	10ms
	Indicator	LED lit when input ON
	Insulation method	Photo-coupling insulation
Internal power supply: Current consumption		For 5VDC: Max 50mA For 24VDC: Max 80mA
accessory		Expansion cable(TP-042EC : 4cm， 14pin)

Outline figure

Upside terminal block

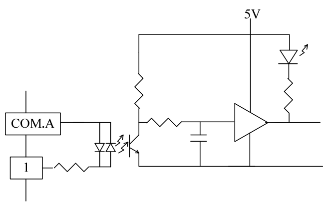


Downside terminal block

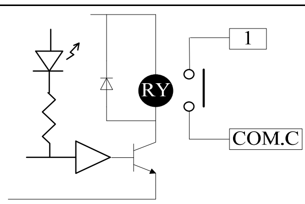
Terminal block		Symbol	Content
	Upside	1 ~ 8	Input terminal
		COM.A	Common terminal
	Downside	1 ~ 8	Output terminal
		COM.B~COM.C	Common terminal

Internal circuit

Input



Output



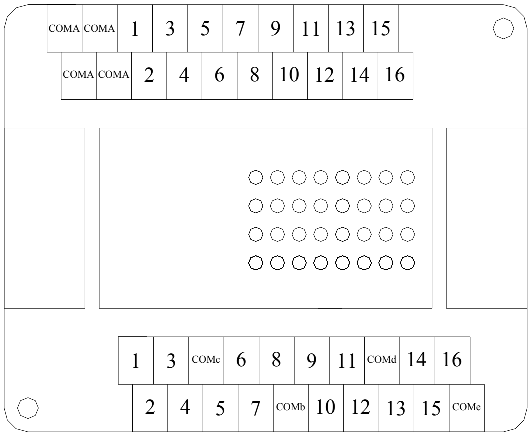
Note:

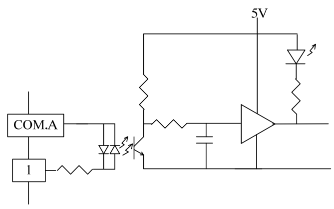
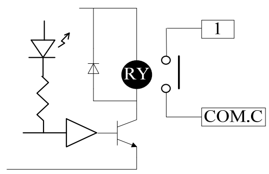
a. 4 points share one common terminal.

b. The common terminals with same symbol in upside and downside are not connected internally.

Chapter 3 Expansion unit specification

1.3.5 TP02-32EMR Specification

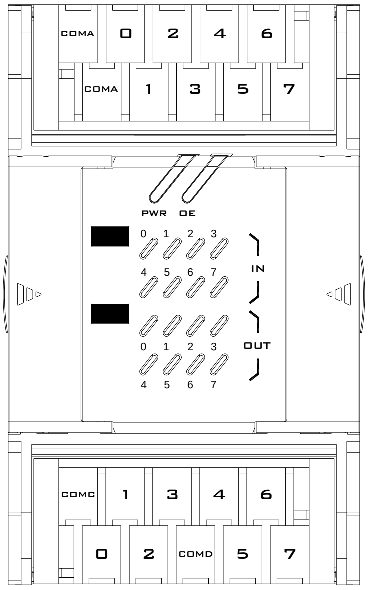
Item		Specification	Outline figure
Input point		16	Upside terminal block  Downside terminal block
Output point		16	
Output	Voltage	AC250V/DC30V	
	Current	2A/1 point ;5A/1common	
	Type	Relay	
	Mechanical lifespan	20,000,000 times	
	Electric lifespan	150,000 times @ 3A	
	Responding time	Below 10ms	
	Minimum load	1 mA @ 5vDC	
	Indicator	LED lit when output ON	
	Insulation method	Relay	
input	Voltage	DC24V +10%～-20%	
	Current	4.8mA @24VDC	
	impedance	5 kΩ Typ.	
	ON level	Above 20Vdc(3.5mA)	
	OFF level	Below 8Vdc(1.5mA)	
	Responding time	10ms	
	Indicator	LED lit when input ON	
	Insulation method	Photo-coupling insulation	
Internal power supply: Current consumption		For 5VDC: Max 50mA For 24VDC: Max 80mA	
Accessory		Expansion cable(TP-042EC : 4cm， 14pin)	

				Internal circuit
Terminal block	Symbol		Content	Input 
	Upside	1 ~ 16	Input terminal	
		COM.A	Common terminal	
	Downside	1 ~16	Output terminal	
		COM.B～COM.E	Common terminal	
Note: a. 4 points share one common terminal. b. The common terminals with same symbol in upside and downside are not connected internally.				Output 

1.3.6 TP03-16EMR Specification

Item		Specification
Input point		8
Output point		8
Output	Voltage	AC250V/DC30V
	Current	2A/1 point; 5A/1 common terminal
	Type	Relay
	Mechanical lifespan	20,000,000 times
	Electric lifespan	100,000 times @ 3A
	Responding time	6ms
	Minimal Load	1 mA @ 5vDC
	Output indicator	LED lit when output ON
	Insulation method	Relay
Input	Voltage	DC24V +10%～-20%
	Current	7mA @24VDC
	Impedance	3kΩ Type.
	ON level	Above 15Vdc (4.2mA)
	OFF level	Below 9 Vdc (2.5mA)
	Responding time	10ms
	Indicator	LED lit when input ON
	Insulation method	Photo-coupling insulation
PWR LED		5V Power LED(Green)
OE LED		Output Enable LED(Green)
Internal power supply: Current consumption		For 5VDC: Max 30mA For 24VDC: Max 45mA
Accessory		Expansion cable(TP03-304EC : 6cm，26pin)

Outline figure

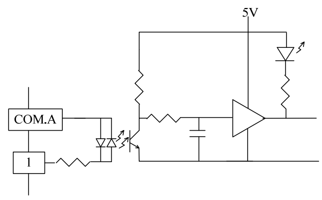


Downside

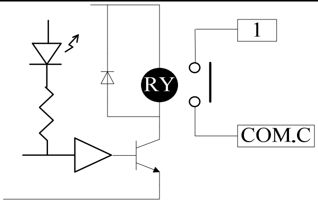
Terminal block	Symbol		Content
	Upside	0 ~ 7	Input terminal
		COM.A	Common terminal
	Downside	0 ~ 7	Output terminal
		COM.C ~COM.D	Common terminal

Internal circuit

Input



Output

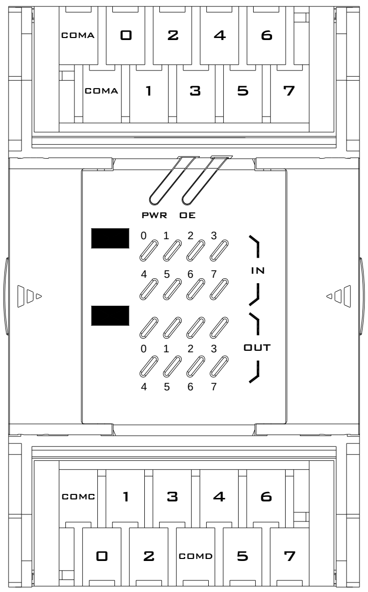


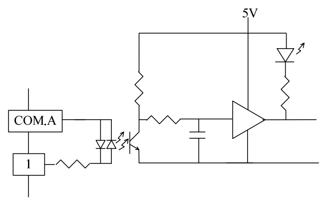
Note:

a. 4 points share one common terminal.

b. The common terminals with same symbol in upside and downside are not connected internally.

1.3.7 TP03-16EMT Specification

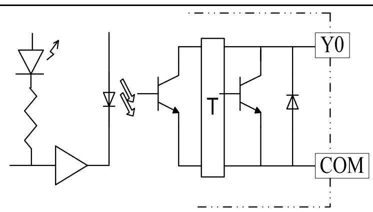
Item		Specification	Outline figure
Input point		8	 Downside
Output point		8	
Output	Voltage	DC 4V~30V	
	Current	0.3A/1 point; 1.2A/1 common terminal	
	Type	NPN transistor	
	Responding time	< 1ms	
	Output indicator	LED lit when output ON	
	Insulation method	Relay	
Input	Voltage	DC24V +10%～-20%	
	Current	7mA @24VDC	
	Impedance	3kΩ Type.	
	ON level	Above 15Vdc (4.2mA)	
	OFF level	Below 9 Vdc (2.5mA)	
	Responding time	10ms	
	Indicator	LED lit when input ON	
	Insulation method	Photo-coupling insulation	
PWR LED		5V Power LED(Green)	
OE LED		Output Enable LED(Green)	
Internal power supply: Current consumption		For 5VDC: Max 30mA For 24VDC: Max 45mA	
Accessory		Expansion cable(TP03-304EC : 6cm，26pin)	

				Internal circuit
Terminal block	Symbol		Content	 Input
	Upside	0 ~ 7	Input terminal	
		COM.A	Common terminal	
	Downside	0 ~ 7	Output terminal	
		COM.C~COM.D	Common terminal	

Note:

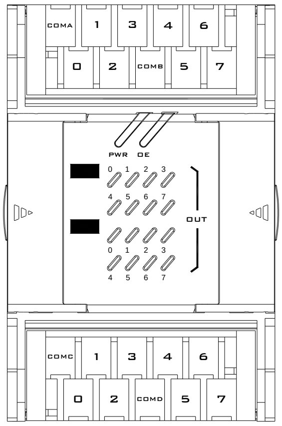
a. 4 points share one common terminal.

b. The common terminals with same symbol in upside and downside are not connected internally.



Output

1.3.8 TP03-16EYR Specification

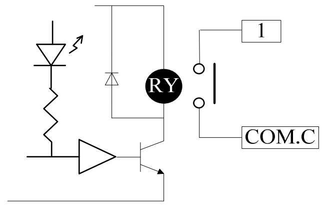
Item		Specification	Outline figure
Input point		0	 Downside
Output point		16	
Output	Voltage	AC250V/DC30V	
	Current	2A/1 point; 5A/1 common terminal	
	Type	Relay	
	Mechanical lifespan	20,000,000 times	
	Electric lifespan	100,000 times @ 3A	
	Responding time	6ms	
	Minimal Load	1 mA @ 5vDC	
	Output indicator	LED lit when output ON	
	Insulation method	Relay	
PWR LED		5V Power LED(Green)	
OE LED		Output Enable LED(Green)	
Internal power supply: Current consumption		For 5VDC: Max 40mA For 24VDC: Max 85mA	
Accessory		Expansion cable(TP03-304EC : 6cm，26pin)	

				Internal circuit
Terminal block	Symbol		Content	
	Upside	0 ~7	Output terminal	
		COM.A~COM.B	Common terminal	
	Downside	0 ~ 7	Output terminal	
		COM.C~COM.D	Common terminal	

Note:

a. 4 points share one common terminal.

b. The common terminals with same symbol in upside and downside are not connected internally.

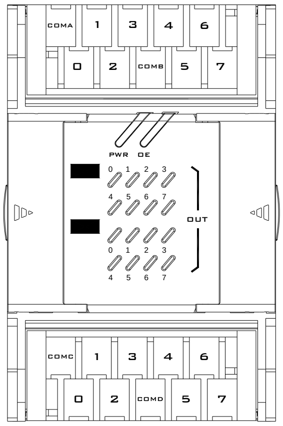


Output

1.3.9 TP03-16EYT Specification

Item		Specification
Input point		0
Output point		16
Output	Voltage	DC 4V~30V
	Current	0.3A/1 point; 1.2A/1 common terminal
	Type	NPN transistor
	Responding time	< 1ms
	Output indicator	LED lit when output ON
	Insulation method	Relay
PWR LED		5V Power LED(Green)
OE LED		Output Enable LED(Green)
Internal power supply: Current consumption		For 5VDC: Max 30mA For 24VDC: Max 45mA
Accessory		Expansion cable(TP03-304EC : 6cm，26pin)

Outline figure



Downside

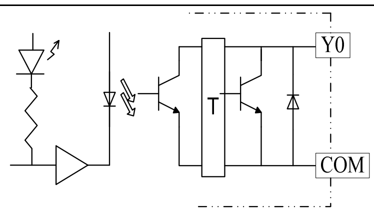
		Symbol	Content
Terminal block	Upside	0 ~ 7	Output terminal
		COM.A~COM.B	Common terminal
	Downside	0 ~ 7	Output terminal
		COM.C~COM.D	Common terminal

Note:

a. 4 points share one common terminal.

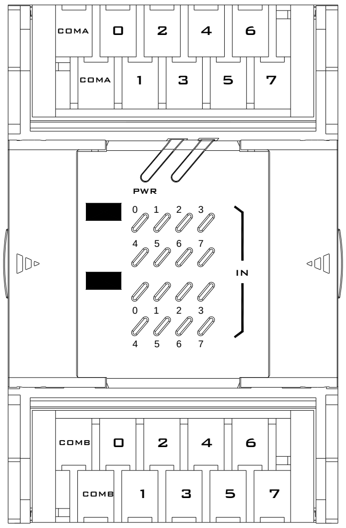
b. The common terminals with same symbol in upside and downside are not connected internally.

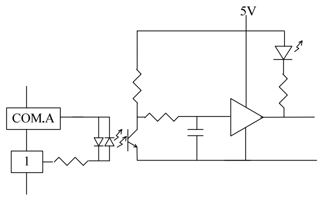
Internal circuit



Output

1.3.10 TP03-16EXD Specification

Item		Specification	Outline figure
Input point		16	 Downside
Output point		0	
Input	Voltage	DC24V +10%～-20%	
	Current	7mA @24VDC	
	Impedance	3kΩ Type.	
	ON level	Above 15Vdc (4.2mA)	
	OFF level	Below 9 Vdc (2.5mA)	
	Responding time	10ms	
	Indicator	LED lit when input ON	
	Insulation method	Photo-coupling insulation	
PWR LED		5V Power LED(Green)	
Internal power supply: Current consumption		For 5VDC: Max 30mA For 24VDC: Max 45mA	
Accessory		Expansion cable(TP03-304EC : 6cm，26pin)	

				Internal circuit
Terminal block	Symbol		Content	Input 
	Upside	0 ~ 7	Input terminal	
		COM.A	Common terminal	
	Downside	0 ~ 7	Input terminal	
		COM.B	Common terminal	

Note:

a. 8 points share one common terminal.

b. The common terminals with same symbol in upside and downside are not connected internally.

2 Analogue expansion unit

2.1 Introduction

2.1.1 Brief

- ◆ Analog expansion unit for input: TP02-4AD+,TP03-4AD,T0P3-8AD,TP03-4RD, TP03-4TM …etc.
- ◆ Analog expansion unit for output: TP02-2DA+,TP03-2DA …etc.
- ◆ Analog expansion unit for both input and output: TP03-3MA …etc.

Note : TP03-8AD,TP03-2DA,TP03-3MA only can be used for TP03 M/H type which version over V1.5 or for TP03 SR type which version over V1.2.

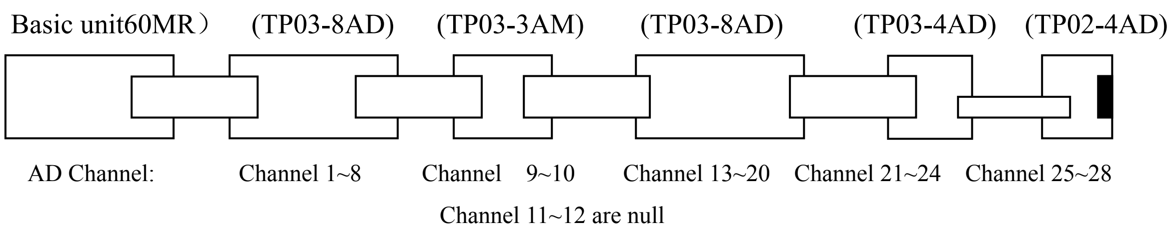
System configuration of analog expansion unit

- ● TP03 20/30 points basic unit(20MR/T、20HR/T、30MR/T、30HR/T) and SR type unit can expanse: 2 TP02-4AD+s and 1 TP02-2DA+,or 1 TP03-8AD and 1 TP03-2DA. That is, the basic unit can expanse to as much as 8 channels of analog input and 2 channels of output.
- ● TP03 40/60 points basic unit(40HR/HT，60HR/HT)can expanse: 1 TP02-4AD+, 1 TP02-2DA+, 7 TP3 analog input expansion units (if installed with 7 TP03-8ADs, the system will have 56 input channels; while if installed with TP03-4RD, the system will have 28 input channels) and 4 analog output expansion units (if installed with 4 TP03-2DAs, the system will have 8 output channels). That is to say, the system can expanse so much to 60 channels of analog input and 10 channels of output.

Note:

- ○ One expansion unit with both input and output will occupy two expansion units (one is for input and the other is for output).
- ○ The total channels of each analog expansion units are different for special function of particular units. For instance, TP02-4AD+ has 4 channels (please refer to respective specification for information about channels)
- ○ TP03expansion analog unit should be connected next to TP03. Then TP02 expansion analog unit should be connect next to TP03 expansion analog unit. The corresponding channels are numbered from TP3 expansion analog unit and then TP02 expansion analog unit.
- ○ TP03-3MA will occupy 4 AD input channels, the first two are the input on TP03-3MA,the other two are null. TP03-3MA will occupy 2 DA output channels, the first one is the output on TP03-3MA,the other one is null.

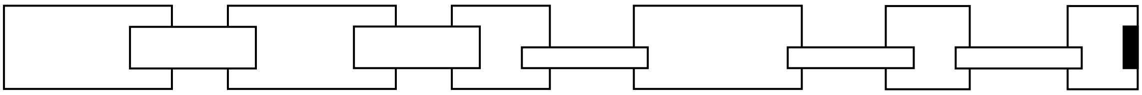
- ■ Example 1:



■ Example 2: Max basic system configuration

Max configuration includes several common I/O expansion units (max 256 points) +（TP02-4AD）*1+（TP03-8AD）*7+（TP02-2DA）*1+（TP03-2DA）*4

Basic unit（60HR）(TP03-8AD)*7 (TP03-2DA)*4 (TP02-32EMR)*6 (TP02-4AD+) (TP02-2DA+)



Note:

1. Among all the expansion units for TP03 basic unit, the TP02 expansion should be installed after TP03 expansion unit, including I/O module, AD and DA module.
2. Then the last unit should be plugged with terminal connector (TP-200EC).
3. the figure is only the logic connect. In fact some of power module will be added into due to different application.(refer to 3.)

2.1.2 Data register and channel of analog expansion module

System will read data in the channel and write them in the data address.

Channel	Analog expansion module for input (System will the read data from individual channels to corresponding address)	Analog expansion module for output (System will the read data from corresponding address to individual channels)
	Data address	Data address
Channel 1	D8436	D8381
Channel 2	D8437	D8382
Channel 3	D8438	D8383
……	……	……
Channel 1	D8444	D8389
Channel 2	D8445	D8390
……	……	
Channel 59	D8494	
Channel 60	D8495	
Channel 61	D8496 (Reserved)	
Channel 62	D8497 (Reserved)	
Channel 63	D8498 (Reserved)	
Channel 64	D8499 (Reserved)	

2.1.3 Setting the system memory

Please set the system memory in advance, before try-run the connected units.

System memory		Setting			Default	Remarks
		TP02 EXTEND MODULE ONLY	TP03 EXTEND MODULE			
			20/30 point And S type	40/60 point		
D8256	Set the **number of Modules** (TP02-4AD+)	0~2	0	0~1	0	20/30 and SR type can't connect with modules mixed by TP03 and TP02 modules
D8257	Set the **number of Modules** (TP03 input expansion units)	0	0~1	0~7	0	
D8258	Set the **number of channels** (TP02-2DA+)	0~2	0	0~2	0	
D8259	Set the **number of channels** (TP03 output expansion units)	0	0~2	0~8	0	
D8260	AD software filter (refer to next page for more)	0: no software filter 1~3: filter mode 1~3			0	
D8261	Operation mode for AD module: to set 4 HEX codes Hxxxx in Register #D8261~D8276. ＝0: AD mode is disabled； ＝1: 0~10V voltage input mode（0~4000）； ＝2: 0~20mA current input mode（0~2000）； ＝3: 4~20mA current input mode or 1~5V voltage input mode（0~2000）； ＝4: PT100 ＝5: PT1000 ＝6: ＝7: ＝8: J-K				H0000	AD Channel 1~4
D8262						AD Channel 5~8
…						…
D8274						AD Channel 53~56
D8275						AD Channel 57~60
D8276						Reserved AD Channel 61~64
D8277	Operation mode for DA module: to set 4 HEX codes Hxxxx in Register #D8277~D8279. ＝0: DA mode is disabled； ＝1: 0~10V voltage input mode(0~4000)； ＝2: 0~20mA current input mode(0~2000)； ＝3: 4~20mA current input mode /1~5V voltage input mode (0~2000)。				0	DA Channel 1~4
D8278						DA Channel 5~8
D8279						DA Channel 9~10
M8257	number error for AD modules	1: D8256，D8257 set value exceeds the range.			0	
M8258	Channel error for DA modules	1: D8258，D8259 set value exceeds the range.			0	

For example: AD mode D8261＝H0123

AD CH1＝3，4~20mA Current input mode or 1~5V Voltage input mode (0~2000)；

AD CH2＝2，0~20mA Current input mode (0~2000)；

AD CH3＝1，0~10V Voltage input mode (0~4000)；

AD CH4＝0，AD mode is disabled.

For example: DA mode D8278＝H3210

DA CH5＝0，DA mode is disabled;

DA CH6＝1，0~10V Voltage output mode (0~4000);

DA CH7＝2，0~20m ACurrent output mode (0~2000);

DA CH8＝3，4~20mA Current output mode or 1~5V Voltage output mode (0~2000).

Software filter for analog input expansion unit

(Mode 1): refresh data in each scan time.

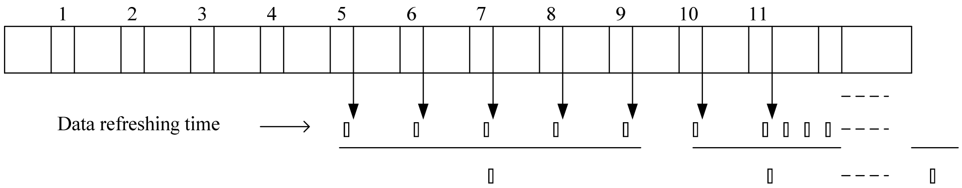
Sampling the latest 5 AD data, then eliminate the max and min data, finally get the average of the remained 3 data.

(Mode 2): refresh data in every 5 scan times.

Sampling the 5 consecutive data from mode 1, then get the average of the 5 data.

(Mode 3): refresh data in every 25 scan times.

Sampling the 5 consecutive data from mode 2, then get the average of the max and min data.



For example: sampling data $_1$=161, sampling data$_2$=120，sampling data$_3$=154, sampling data$_4$=160, sampling data$_5$=190, sampling data$_6$=169, sampling data$_7$=110, sampling data$_8$=121, sampling data$_9$=150, sampling data$_{10}$=198, sampling data$_{11}$=199.

◆ Mode 1:

① Refreshed data = (161+154+160)/3=158— filter (1, 2, 3, 4, 5)
Eliminate max 190 and min 120.

② Refreshed data= (154+160+169)/3=161—Filter (2, 3, 4, 5, 6)
Eliminate max 190 and min 120.

③ Refreshed data= (154+160+169)/3=161—Filter (3, 4, 5, 6, 7)
Eliminate max 190 and min 110.

:

:

□ Refreshed data= (121+150+198)/3=156—Filter (7, 8, 9, 10, 11)
Eliminate max 199 and min 110.

◆ Mode 2：

Get the average of the 5 data from mode 1.

(□+□+□+□+□)/5

◆ Mode 3：

Get the average of the max and min data among 5 consecutive data from mode 2.

This mode can efficiently filter the ripple noise.

(max + min)/2,

Max and min is inside □□□□□.

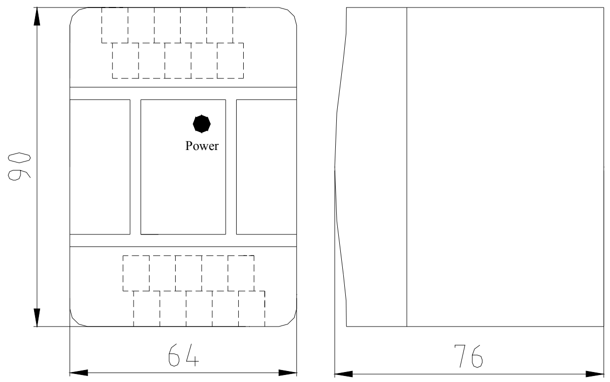
Chapter 3 Expansion unit specification

2.2 General Specification for analog expansion unit

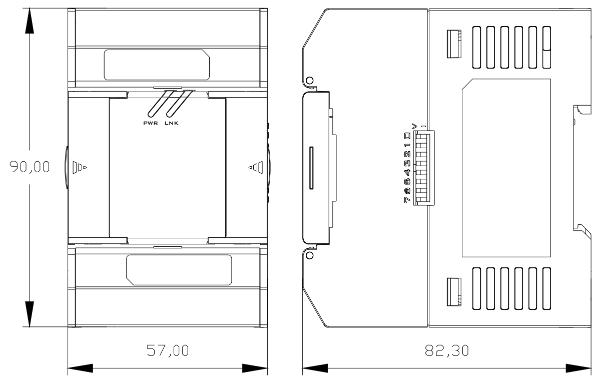
Item	Analog expansion unit
Storage temperature	-25~70 ℃
Ambient temperature	0~55 ℃
Humidity range	5~90%HR(Non condense)
Installation	Install directly or DIN rail
Ground	Less than100 ohm
Insulation system	Photo-coupling isolation
Insulation impedance	10M Ω or above, 500V DC (between output terminal and secondary circuit)
Withstand voltage for insulation	500V AC/1min (between output terminal and secondary circuit)
Indicator	LED (5VPower indicator LED: Green)

2.3 Dimension

2.3.1 TP02 analog expansion unit

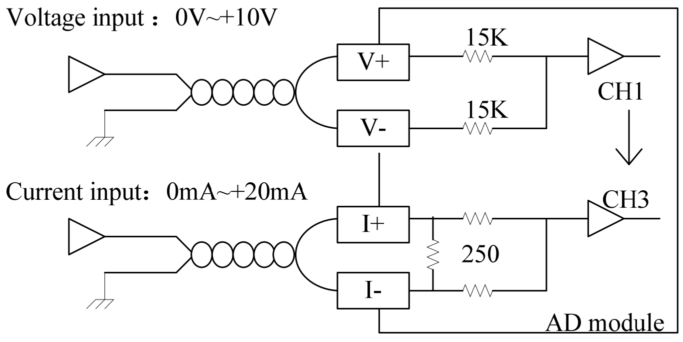


2.3.2 TP03 analog expansion unit



2.4 Wiring for analog expansion module

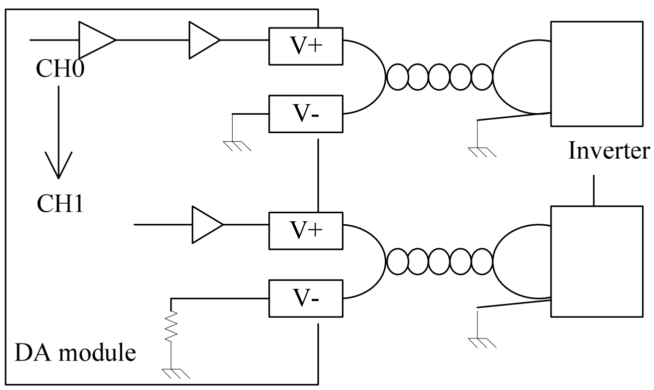
Wiring figure of Input (A/D) analog expansion module:



1. The cable for analog input should be standard isolated twisted cable, routed away power line and other line which will interrupt others. It is recommended that the cable should be less that 3m in length.
2. Connect the common terminal to system ground. Then properly ground the system.

Both voltage signal and current signal are available for analog units. However the signal should be less than ±15V or ±30mA with the switch properly set or the analog unit will be damaged.

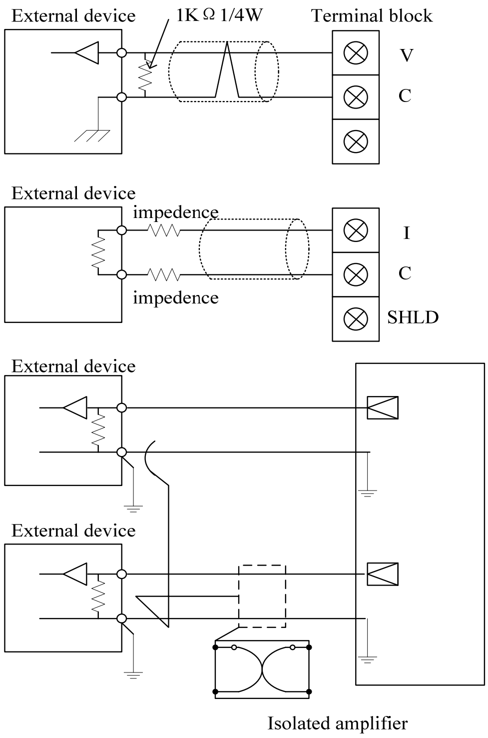
Wiring figure of Output (D/A) analog expansion module:



1. The cable for analog input should be standard isolated twisted cable, routed away power line and other line which will interrupt others. It is recommended that the cable should be less that 3m in length.
2. The improper wiring will lead to error operation or damage the unit. Short circuit the voltage output will irrevocably destroy the unit.

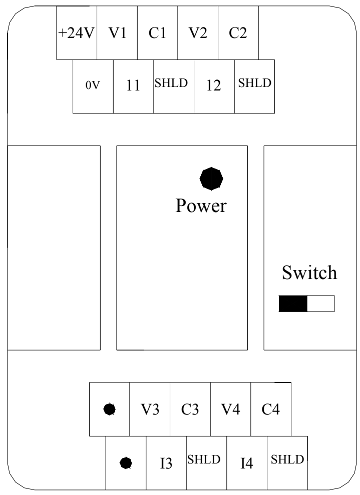
You can set voltage output or current output for the unit.：

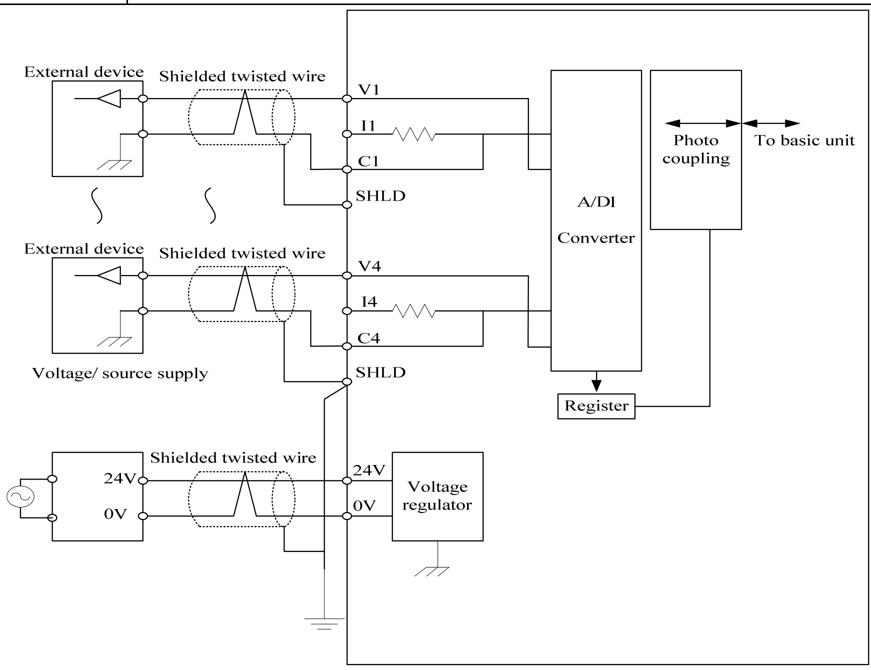
- Keep the wire from the shield as short as possible (30mm or less).
- Connect SHLD terminal with shield-net.
- Connect Flame ground (FG) and SHLD terminal with wire of apx. 1.25mm^2 .
- Use this module dedicated constant-voltage supply or 24VDC power supply of basic module for the 24VDC input power supply.


External device
1KΩ 1/4W
Terminal block
V
C
External device
impedence
impedence
I
C
SHLD
External device
External device
Isolated amplifier

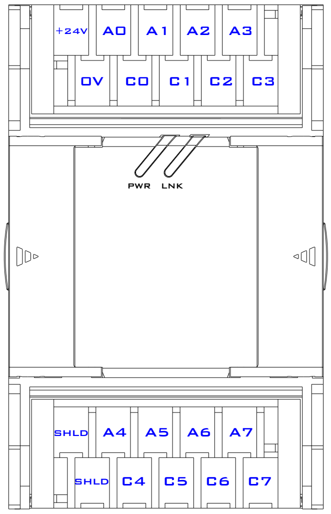
2.5 Electric Specification

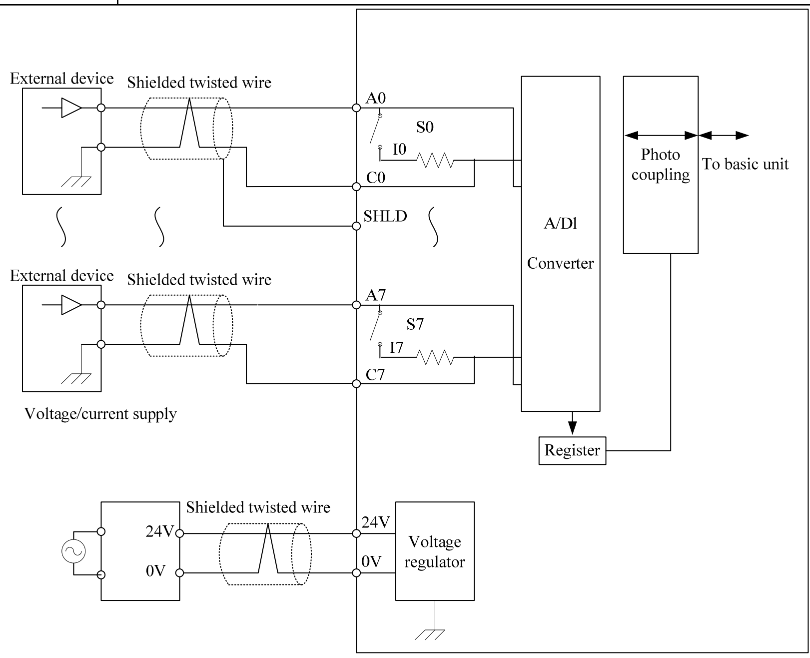
2.5.1 TP02-4AD+ Specification

<table>
<tr><td colspan="2" rowspan="2">Item</td><td colspan="2">Specification</td></tr>
<tr><td>Voltage</td><td>Current</td></tr>
<tr><td colspan="2">Analog input range</td><td>0V~10V or 1V~5V ,
Input impedance 30KΩ</td><td>0mA~20mA or 4mA~20mA ,
Input impedance 250Ω</td></tr>
<tr><td colspan="2">Data range</td><td>0000(0V)~4000(10V) or
0000(1V)~2000(5V)</td><td>0000(0mA)~2000(20mA)or
0000(4mA)~2000(20mA)</td></tr>
<tr><td colspan="2">Resolution</td><td>2.5 mV</td><td>10 μA</td></tr>
<tr><td colspan="2">Accuracy</td><td>±5% or less(at 25 ℃)</td><td>±1%or less(at 0~55 ℃)</td></tr>
<tr><td colspan="2">Transmit speed</td><td>1scan time/ 4 Channel</td><td rowspan="10">

Outline figure</td></tr>
<tr><td rowspan="6">Terminal block</td><td>V1~V4</td><td>Voltage input terminals for Voltage signal between V,C.</td></tr>
<tr><td>I1~I4</td><td>Current input terminals for Current signal between I,C and short circuit V, I.</td></tr>
<tr><td>C1~C4</td><td>V or I Common terminal</td></tr>
<tr><td>SHLD</td><td>Please connect Shielded terminal to FG on the House. And all shielded terminals are internally connected.</td></tr>
<tr><td>24V</td><td>24VDC input terminal (+)</td></tr>
<tr><td>0V</td><td>24VDC input terminal (-)</td></tr>
<tr><td colspan="2">Power indicator</td><td>LED (5V power LED: Green)</td></tr>
<tr><td colspan="2">Internal power</td><td>5VDC:Max current 50mA</td></tr>
<tr><td colspan="2">External power</td><td colspan="2">24VDC±10%(Consumption current: Max 100 mA)</td></tr>
<tr><td colspan="2">Accessory</td><td colspan="2">Installation manual, Expansion cable(TP-042EC : 4cm，14pin)</td></tr>
<tr><td>Principle figure</td><td colspan="3">
</td></tr>
</table>

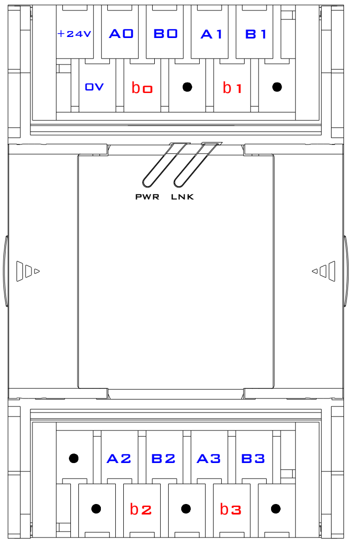
2.5.2 TP03-8AD Specification

<table>
<tr><th rowspan="2" colspan="2">Item</th><th colspan="3">Specification</th></tr>
<tr><th colspan="3">Voltage</th><th>Current</th></tr>
<tr><td colspan="2">Analog input range</td><td colspan="3">0V~10V or 1V~5V ,
Input impedance 30KΩ</td><td>0mA~20mA or 4mA~20mA ,
Input impedance 250Ω</td></tr>
<tr><td colspan="2">Data range</td><td colspan="3">0000(0V)~4000(10V)or
0000(1V)~2000(5V)</td><td>0000(0mA)~2000(20mA)or
0000(4mA)~2000(20mA)</td></tr>
<tr><td colspan="2">Resolution</td><td colspan="3">2.5 μA</td><td>10 μA</td></tr>
<tr><td colspan="2">Accuracy</td><td colspan="3">±1% or less(at 25 ℃)</td><td>±1%or less(at 0~55 ℃)</td></tr>
<tr><td colspan="2">Transmit speed</td><td colspan="3">1scan time/ 8 Channel</td><td rowspan="14">

Outline figure</td></tr>
<tr><td rowspan="5">Terminal block</td><td>A0~A7</td><td colspan="3">Analog input terminal</td></tr>
<tr><td>C0~C7</td><td colspan="3">Common terminal for A0~A7</td></tr>
<tr><td>SHLD</td><td colspan="3">Please connect Shielded terminal to FG on the House. And all shielded terminals are internally connected.</td></tr>
<tr><td>24V</td><td colspan="3">24VDC input terminal(+)</td></tr>
<tr><td>0V</td><td colspan="3">24VDC input terminal(-)</td></tr>
<tr><td colspan="2" rowspan="5">Voltage /Current input switch</td><td rowspan="2">S0</td><td>I</td><td>A0: Current input</td></tr>
<tr><td>V</td><td>A0: Voltage input</td></tr>
<tr><td colspan="3">:</td></tr>
<tr><td rowspan="2">S7</td><td>I</td><td>A7: Current input</td></tr>
<tr><td>V</td><td>A7: Voltage input</td></tr>
<tr><td colspan="2">Power indicator</td><td colspan="3">PWR:+24 V Power LED(Green)
LNK: Link LED(Green)</td></tr>
<tr><td colspan="2">Internal power</td><td colspan="3">5VDC:Max current 30mA</td></tr>
<tr><td colspan="2">External power</td><td colspan="4">24VDC±10% (Consumption current: Max 50mA)</td></tr>
<tr><td colspan="2">Accessory</td><td colspan="4">Installation manual, Expansion cable(TP03-304EC : 6cm, 26pin)</td></tr>
<tr><td>Principle figure</td><td colspan="5">
</td></tr>
</table>

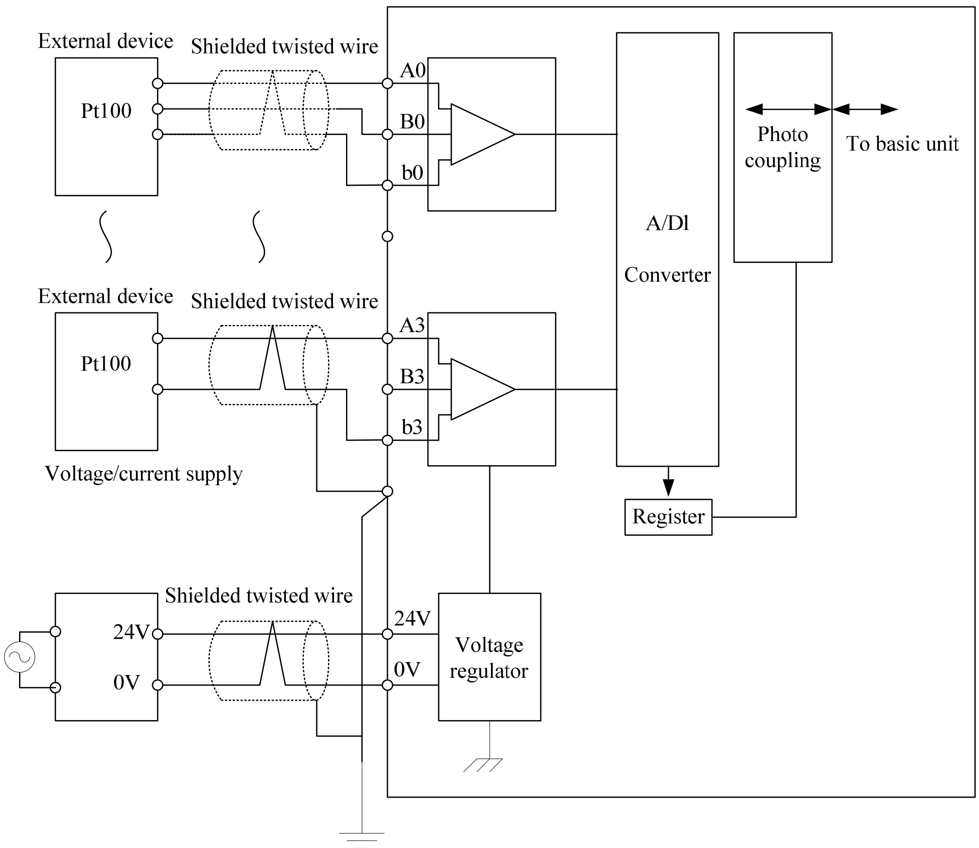
2.5.3 TP03-4RD Specification

Item		Specification
Temperature range		Pt100: -100℃~600℃(60Ω~330Ω)
Digital output		0350~4000(-100℃~600℃)
Resolution		2.5 mV
Accuracy		±0.5% FSR (-100℃~600℃)
Sensor type		RTD; α=0.00385;2 or 3 wires
Transmit speed		1scan time/ 4 Channel
Terminal block	A0~A3	Thermistor (Pt100) signal input A
	B0~B3	Thermistor (Pt100) signal input B
	B0~b3	Thermistor (Pt100) signal input b
	24V	24VDC input terminal(+)
	0V	24VDC input terminal(-)
Power indicator		PWR:+24 V Power LED(Green) LNK: Link LED(Green)
Internal power		5VDC:Max current 50mA
External power		24VDC±20% (Consumption current: Max 100 mA)
Accessory		Installation manual, Expansion cable(TP03-304EC : 6cm, 26pin)

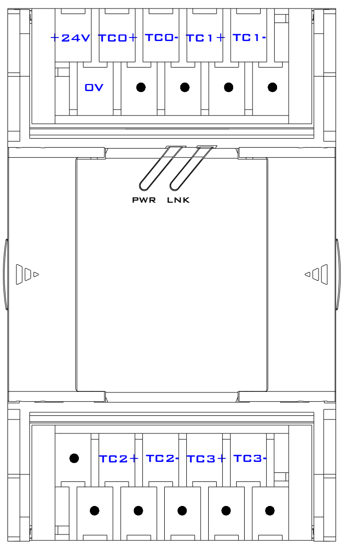
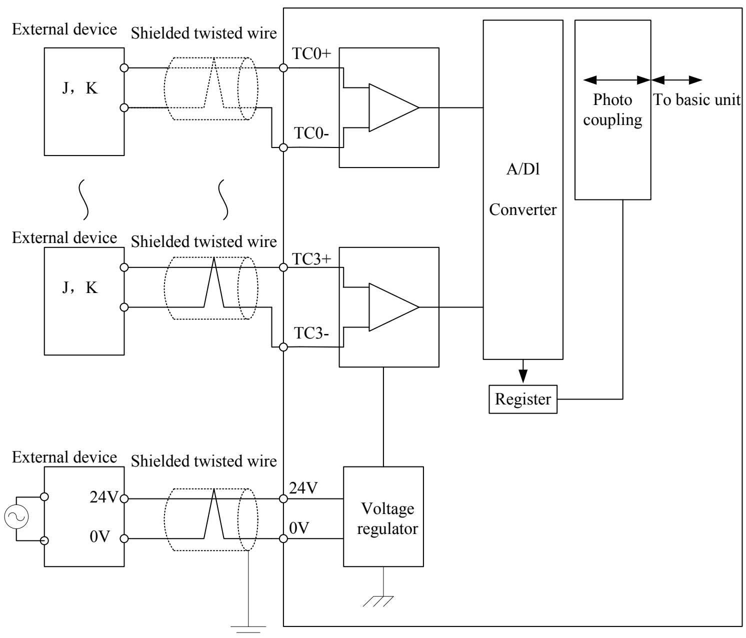


Outline figure

Principle figure

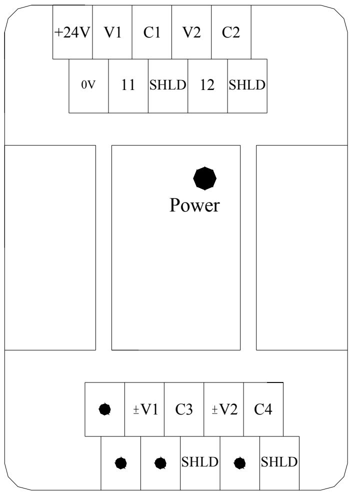
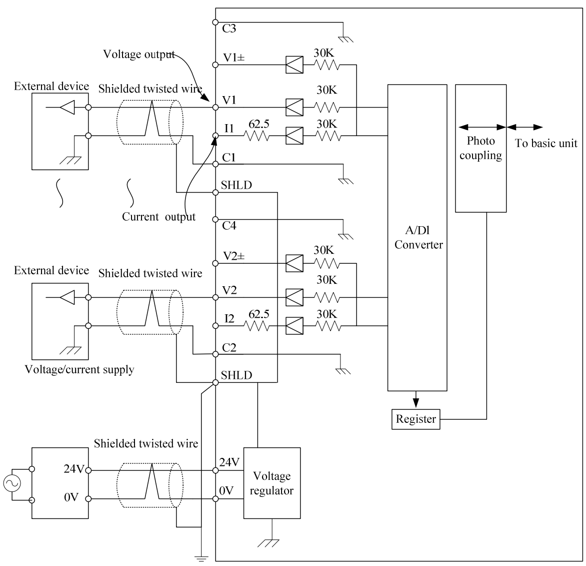


2.5.4 TP03-4TM Specification

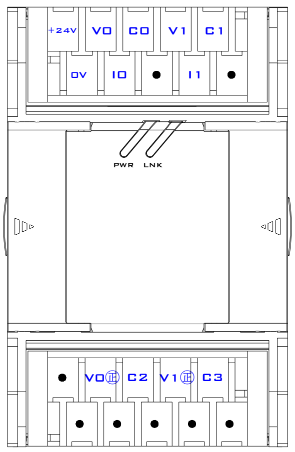
Item		Specification	
		J-type	K-type
Temperature range		0℃~700℃	0℃~1200℃
Digital output		0000~4000	0000~4000
Resolution		2.5 mV	
Accuracy		±0.5% FSR (0℃~1200℃)	
Sensor type		Thermocouple J-type /K-type	
Transmit speed		1scan time/ 4 Channel	
Terminal block	TC0+~TC3+	Thermistor (J,K type) signal input+ terminal	
	TC0-~TC3-	Thermistor (J,K type) signal input- terminal	
	24V	24VDCPower input terminal(+)	
	0V	24VDCPower input terminal(-)	
Power indicator		PWR:+24 V Power LED(Green) LNK: Link LED(Green)	
internal power		5VDC:Max current 50mA	
External power		24VDC±20% (Consumption current: Max 100 mA)	
Accessory		Installation manual, Expansion cable(TP03-304EC : 6cm, 26pin)	Outline figure
Principle figure	 		

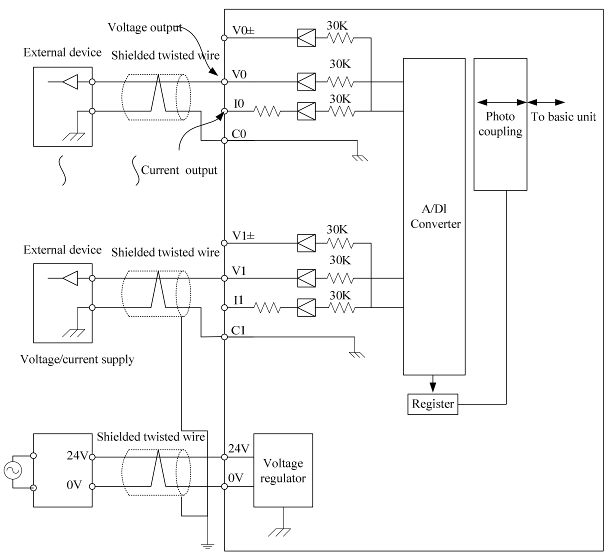
Chapter 3 Expansion unit specification

2.5.5 TP02-2DA+ Specification

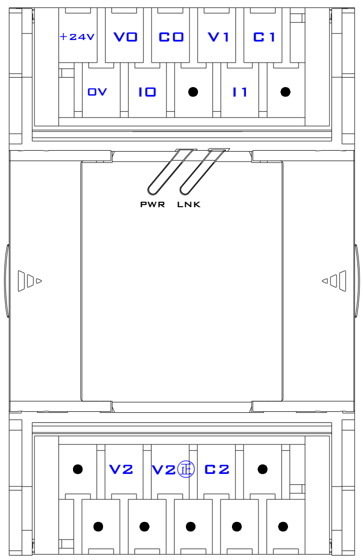
Item		Specification	
		Voltage	Current
Analog output range		0V~10V or 1V~5V, external impendence should be less than 500Ω	0mA~20mA or 4mA~20Ma, Principle figure 500Ω.
Data range		0000(0V)~4000(10V) or 0000(1V)~2000(5V)	0000(0mA)~2000(20mA) or 0000(4mA)~2000(20mA)
Resolution		2.5 mV	10 µA
Accuracy		±5% or less (at 25 ℃)	±1% or less (0~55 ℃)
Transmit speed		1scan time/ 4 Channel	 Outline figure
Terminal block	V1~V2	Voltage output terminal, input voltage signal between VC	
	C1~C2	Common ground	
	V1±~V2±	Voltage output terminal, output voltage signal (-10V~+10V)between V and C terminal (V1,V2 and V1±,V2± can not be used at same time)	
	C3~C4	Common ground	
	I1~I2	output terminals for Current signal between I,C .	
	SHLD	Please connect Shielded terminal to FG on the House. And all shielded terminals are internally connected.	
	24V	24VDC Power input terminal(+)	
	0V	24VDC Power input terminal(-)	
Power indicator		LED (5V power LED: Green)	
Internal power supply		5VDC:Max current 50mA	
External power		24VDC±10%(Consumption current: Max 100 mA)	
Accessory		Installation manual, Expansion cable(TP-042EC : 4cm，14pin)	
Principle figure			

2.5.6 TP03-2DA Specification

<table>
<tr><td rowspan="2" colspan="2">Item</td><td colspan="4">Specification</td></tr>
<tr><td colspan="2">Voltage</td><td colspan="2">Current</td></tr>
<tr><td rowspan="3" colspan="2">Analog output range</td><td>V0-C0,V1-C1:</td><td>0V~10V or 1V~5V</td><td rowspan="2">I0-C0，
I1-C1:</td><td rowspan="2">0mA~20mA or
4mA~20mA.</td></tr>
<tr><td>±V0-C2, C1-C3:</td><td>-10V~ +10V.</td></tr>
<tr><td colspan="2">external impendence should be more than 500Ω</td><td colspan="2">external impendence should be less than 500Ω.</td></tr>
<tr><td colspan="2">Data range</td><td colspan="2">0000(0V) ~ 4000(10V) or
0000(1V) ~ 2000(5V) or
0000(-10V)~4000(+10V)</td><td colspan="2">0000(0mA) ~ 2000(20mA) or
0000(4mA) ~ 2000(20mA)</td></tr>
<tr><td colspan="2">Resolution</td><td colspan="2">2.5 mV</td><td colspan="2">10 µA</td></tr>
<tr><td colspan="2">Accuracy</td><td colspan="2">±1% or less (at 25 ℃)</td><td colspan="2">±1% or less (0~55 ℃)</td></tr>
<tr><td colspan="2">Transmit speed</td><td colspan="4">1scan time/ 4 Channel</td></tr>
<tr><td rowspan="7">Terminal block</td><td>V0~V1</td><td colspan="4">Voltage output terminal, output voltage signal between terminal V and C.</td></tr>
<tr><td>I0~I1</td><td colspan="2">Current output terminal, output current signal between terminal I and C</td><td colspan="2" rowspan="9">

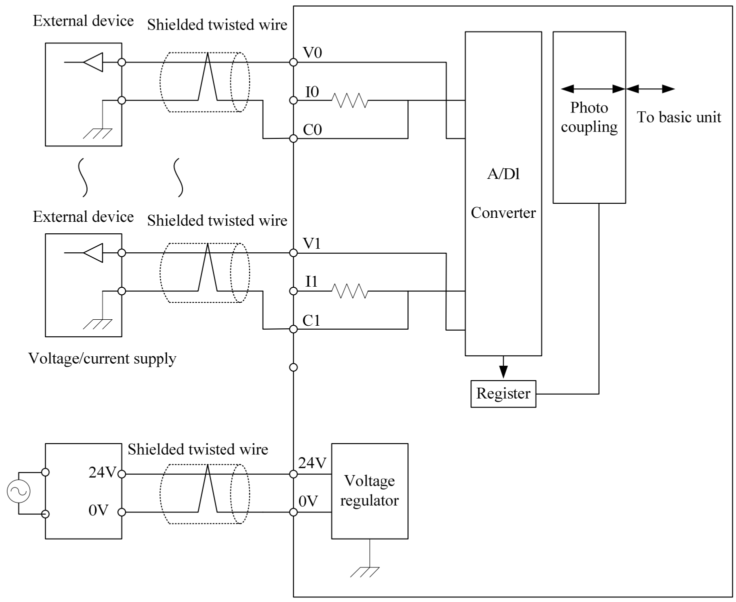
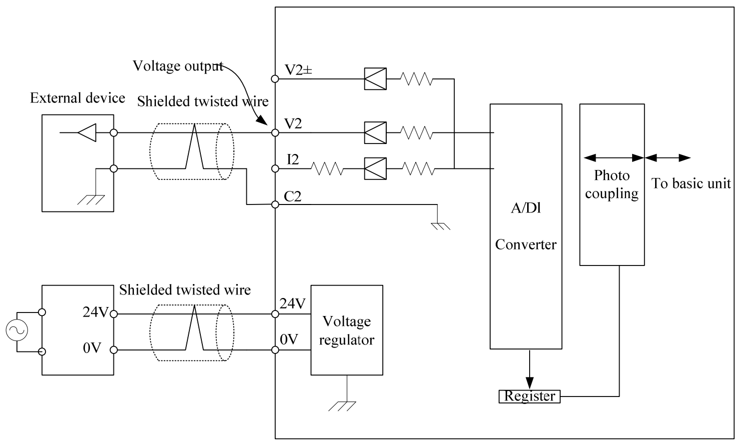
Outline figure</td></tr>
<tr><td>C0~C1</td><td colspan="2">Common ground for V0~V2,I0~I2</td></tr>
<tr><td>V0±~ V1±</td><td colspan="2">Voltage output terminal, output voltage signal (-10V~+10V)between V and C terminal (V0,V1 and V0±,V1± can not be used at same time)</td></tr>
<tr><td>C2~C3</td><td colspan="2">Common ground for V0±~V1±</td></tr>
<tr><td>24V</td><td colspan="2">24VDCPower input terminal(+)</td></tr>
<tr><td>0V</td><td colspan="2">24VDCPower input terminal(-)</td></tr>
<tr><td colspan="2">Power indicator</td><td colspan="2">PWR:+24 V Power LED(Green)
LNK: Link LED(Green)</td></tr>
<tr><td colspan="2">internal power</td><td colspan="2">5VDC:Max current 30mA</td></tr>
<tr><td colspan="2">External power</td><td colspan="4">24VDC±10%(Consumption current: Max 100 mA)</td></tr>
<tr><td colspan="2">Accessory</td><td colspan="4">Installation manual, Expansion cable(TP-304EC : 6cm, 26pin)</td></tr>
<tr><td>Principle figure</td><td colspan="5">
</td></tr>
</table>

2.5.7 TP03-3MA Specification

<table>
<tr><td colspan="2" rowspan="2">Item</td><td colspan="4">Specification</td></tr>
<tr><td colspan="2">Voltage</td><td colspan="2">Current</td></tr>
<tr><td rowspan="3">Input</td><td rowspan="2">Input range</td><td>Vin0-COM0
Vin1-COM1</td><td>0V~10V or
1V~5V</td><td>Iin0-COM0
Iin1-COM1</td><td>0mA~20mA or
4mA~20mA ,</td></tr>
<tr><td colspan="2">Input impedance 30KΩ</td><td colspan="2">Input impedance 250Ω</td></tr>
<tr><td>Data range</td><td colspan="2">0000(0V)~4000(10V) or
0000(1V)~2000(5V)</td><td colspan="2">0000(0mA)~2000(20mA) or
0000(4mA)~2000(20mA)</td></tr>
<tr><td rowspan="4">Output</td><td rowspan="3">Output range</td><td>Vout -COM</td><td>0V~10V or 1V~5V</td><td rowspan="2">Iout -COM</td><td rowspan="2">0mA~20mA or
4mA~20mA.</td></tr>
<tr><td>Vout± -COM</td><td>-10V~ +10V.</td></tr>
<tr><td colspan="2">external impendence should be more than 500Ω</td><td colspan="2">external impendence should be less than 500Ω.</td></tr>
<tr><td>Data range</td><td colspan="2">0000(0V) ~ 4000(10V) or
0000(1V) ~ 2000(5V) or
0000(-10V)~4000(+10V)</td><td colspan="2">0000(0mA) ~ 2000(20mA) or
0000(4mA) ~ 2000(20mA)</td></tr>
<tr><td colspan="2">Resolution</td><td colspan="2">2.5 mV</td><td colspan="2">10 μA</td></tr>
<tr><td colspan="2">Accuracy</td><td colspan="2">±1% or less (at 25 ℃)</td><td colspan="2">±1% or less (0~55 ℃)</td></tr>
<tr><td colspan="2">Transmission speed</td><td colspan="2">1scan time/ 3 Channel</td><td colspan="2" rowspan="11">

Outline figure</td></tr>
<tr><td rowspan="8">Terminal block</td><td>Vin0～Vin1</td><td colspan="2">Voltage output terminal, output voltage signal between terminal V and C.</td></tr>
<tr><td>Iin0～Iin1</td><td colspan="2">Current input terminals for Current signal between I,C and short circuit V, I.</td></tr>
<tr><td>Com0~Com1</td><td colspan="2">Common ground for Vin0~Vin1or Iin1~Iin1</td></tr>
<tr><td>Vout or Vout±</td><td colspan="2">Voltage output terminal, output voltage signal (-10V~+10V)between Vout and Cout terminal (Vout and Vout± can not be used at same time)</td></tr>
<tr><td>Iout</td><td colspan="2">Current output terminal ,output current signal(0~20mA) between Iout and Com.</td></tr>
<tr><td>Com</td><td colspan="2">Common ground for Vout, Vout±,Iout</td></tr>
<tr><td>24V</td><td colspan="2">24VCD input terminal(+)</td></tr>
<tr><td>0V</td><td colspan="2">24VCD input terminal(-)</td></tr>
<tr><td colspan="2">Power indicator</td><td colspan="2">PWR:+24 V Power LED(Green)
LNK: Link LED(Green)</td></tr>
<tr><td colspan="2">internal power supply</td><td colspan="2">5VDC:Max current 30mA</td></tr>
<tr><td colspan="2">External power supply</td><td colspan="4">24VDC±20%(Consumption current: Max 85 mA)</td></tr>
<tr><td colspan="2">Accessory</td><td colspan="4">Installation manual, Expansion cable(TP03-304EC : 6cm, 26pin)</td></tr>
</table>

Chapter 3 Expansion unit specification

Principle figure	Input circuit  Output circuit 

3 How many expansion unit can be connected to base unit

The maximal number of expansion unit than can be connected to base unit is related to the specification about base unit and the power consumed by expansion unit

Next four will be think about.

1. The maximal points about digital I/O defined by base unit；(refer to 3.1)
2. The maximal points about analog I/O defined by base unit；(refer to 3.1)
3. The maximal power consumption about 5V internal. (refer to 3.2.1; 3.2.2)
4. The maximal number of output that are on at the same time. . (refer to 3.2.3; 3.2.4)

3.1 Specification

Base unit	Digital I/O（base unit + expansion unit）	Channels of AD	Channels of DA
S type	80	8	2
20/30 M type	128	8	2
20/30 H type	256	8	2
40/60 H type	256	60	10

3.2 Power consumption

3.2.1 5V power provide by base unit

Base unit	5V output(mA)
S Type	160
20/30 Relay type	410
20/30 Transistor type	340
40/60 Relay type	410
40/60 Transistor type	280

3.2.2 5V power consumed by expansion unit

Expansion unit	5V current (mA)(max)
TP03-16EXD	20
TP03-16EMR	30
TP03-16EYR	40
TP03-16EMT	30
TP03-16EYT	40
TP03-8AD	30
TP03-2DA	30

Table 3.2.2

3.2.3 24V internal power provide by base unit

All base unit provide 200mA 24V internal power

Every relay output needs 5mA current of 24v internal when it’s on .

Every transistor output of expansion unit needs 5mA current of 24v internal when it’s on.

All transistor output of base unit don’t need 24V internal

3.3 For example

There is application which needs one TP03-60HT-A and four TP03-16EMR and one TP03-8AD.There are thirty relay output at same time. We will calculate the consumption of power to detect if it's suitable for TP03.

The first step，calculate 5v current (refer to Table 3.2.2)

unit	5V current（mA）
TP03-16EMR	30
TP03-16EMR	30
TP03-16EMR	30
TP03-16EMR	30
TP03-8AD	30
Total	150

The second step ，calculate 24v current .

output	Number of on at the same time	Current of 24v internal (mA)
Relay output	30	150
Transistor output of expansion unit	0	0
Total	-	150

The third step, accomplish the table 3.2.3. If there are OK all, then can judge the TP03s are suitable for the application.

TP03-60HT-A+4*TP03-16EMR+TP03-8AD

Item	**Digital I/O points**	**AD/DA points**	**5V current（mA）**	**24v current**
specification	256	60/10	280	200
The application	124	8/0	150	150
judge	OK	OK	OK	OK

table 3.2.3

3.4 Power module TP03-01SPS-A

TP03-01SPS-A is an expansion power module，It must be connect between expansion modules. It provide power of 5v and 24v internal to the expansion modules on right side.

The specification

Item	**specification**
5V	250mA
24V internal	250mA
24V external	400mA

Chapter4 Dimension and installation

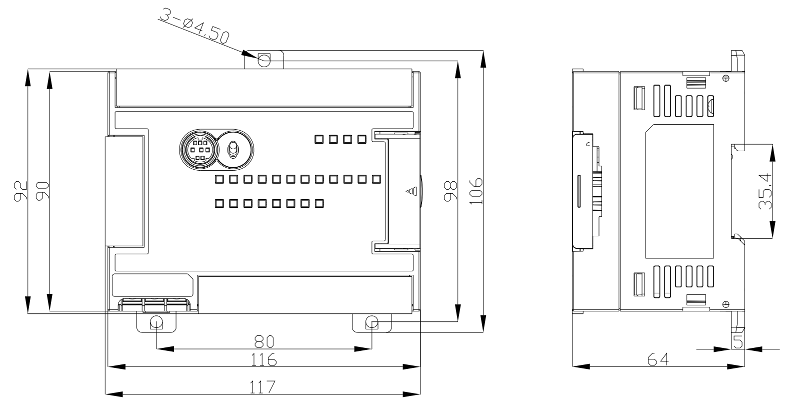
Chapter4 Dimension and installation.. 4-1
1 Outline dimension.. 4-1
1.1 Basic unit 4-1
1.2 TP02 expansion unit 4-2
1.3 TP03 expansion unit and power unit 4-3
1.4 TP03 communication unit.. 4-3
2 Installation.. 4-5
2.1 Ambient environment 4-5
2.2 Installation of basic unit and expansion unit.. 4-5
2.2.1 Directly installation.. 4-6
2.2.2 DIN Rail installation.. 4-8
2.3 Installation for expansion cable and termination connector 4-8

Chapter4 Dimension and installation

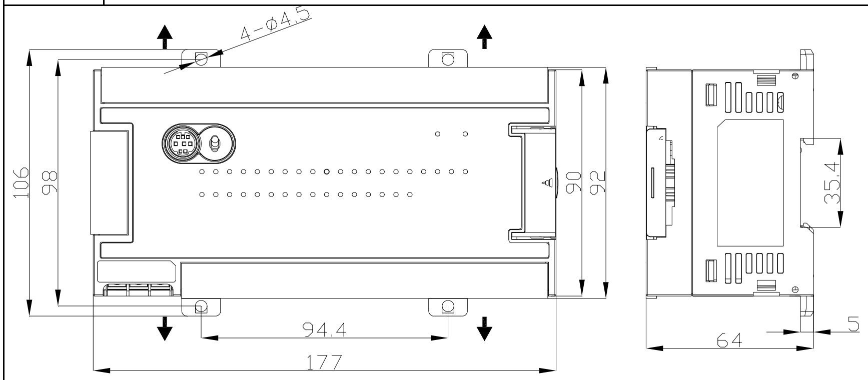
1 Outline dimension

1.1 Basic unit

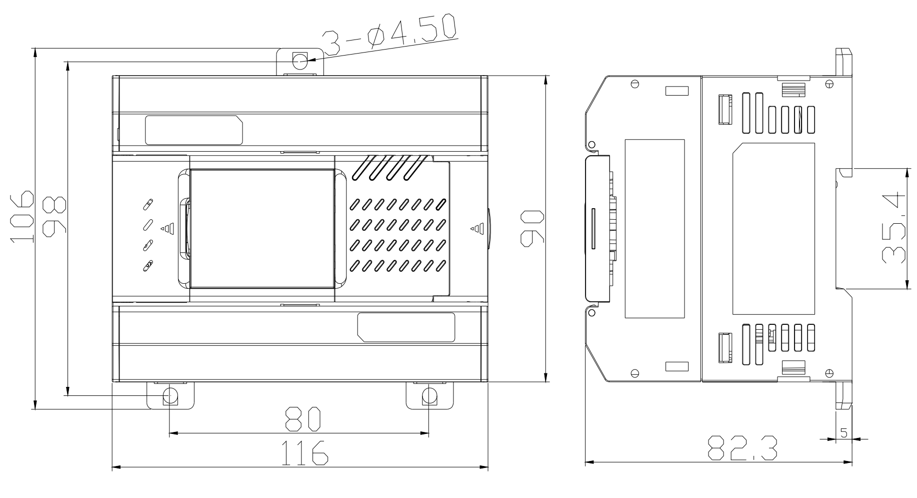
14/20	TP03-14SR-A
	TP03-20SR-A



26/36	TP03-26SR-A
	TP03-36SR-A

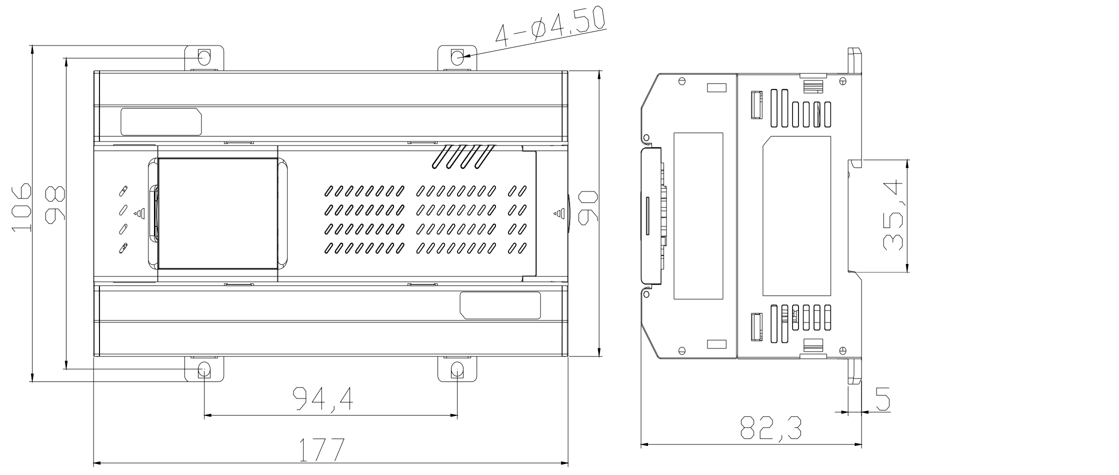


20/30	TP03-20MR-A / TP03-20HR-A / TP03-20MT-A / TP03-20HT-A
	TP03-30MR-A / TP03-30HR-A / TP03-30MT-A / TP03-30HT-A



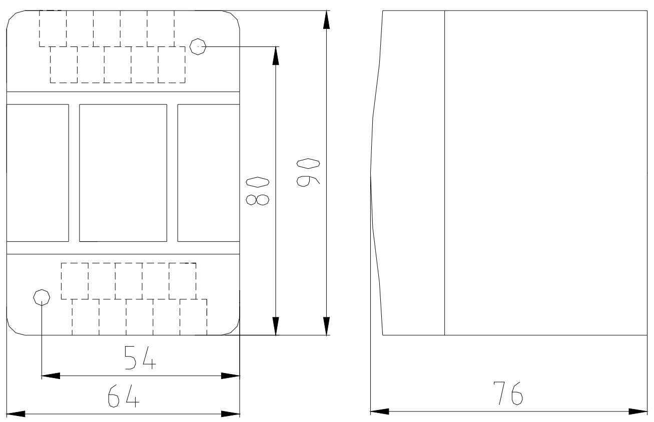
Chapter4 Dimension and installation

40/60	TP03-40HR-A / TP03-40HT-A / TP03-40HR-D
	TP03-60HR-A / TP03-60HT-A / TP03-60HR-D

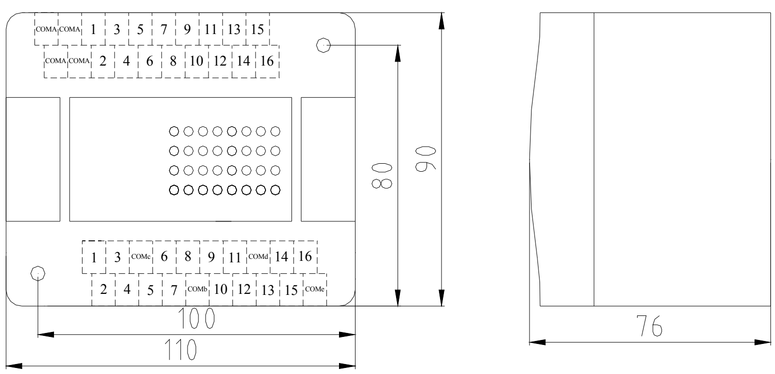


1.2 TP02 expansion unit

	TP02-16EXD/ TP02-16EYR/ TP02-16EYT/ TP02-16EMR/ TP02-4AD+/ TP02-2DA+



	TP02-32EMR



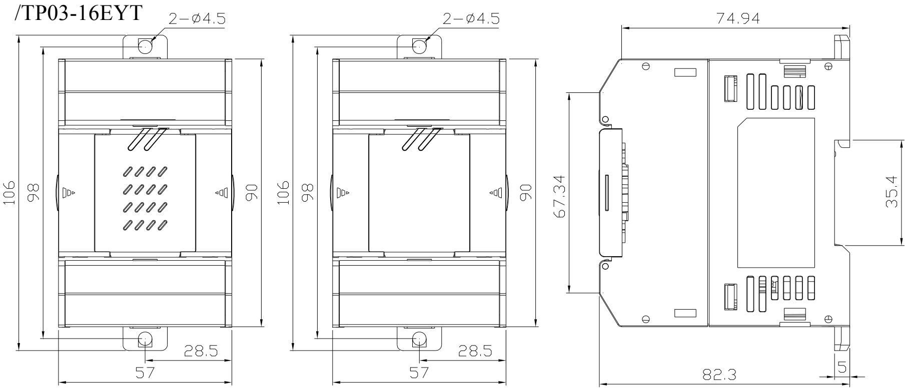
Chapter4 Dimension and installation

1.3 TP03 expansion unit and power unit

	TP03-16EMR-A/TP03-16EMT/TP03-16EYR/TP03-16EYT/TP03-16EXD TP03-2DA/ TP03-3MA/ TP03-8AD/ TP03-4TM/TP03-4RD
	TP03-01SPS-A

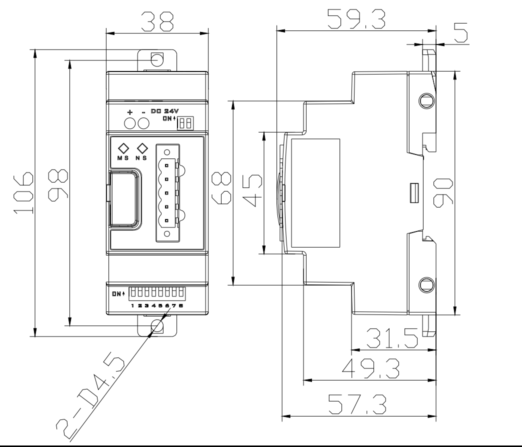
TP03-16EMR/TP03-16EYR /TP03-16EXD/TP03-16EMT /TP03-16EYT

TP03-4TM/ TP03-2DA/ TP03-3MA/ TP03-8AD/TP03-01SPS

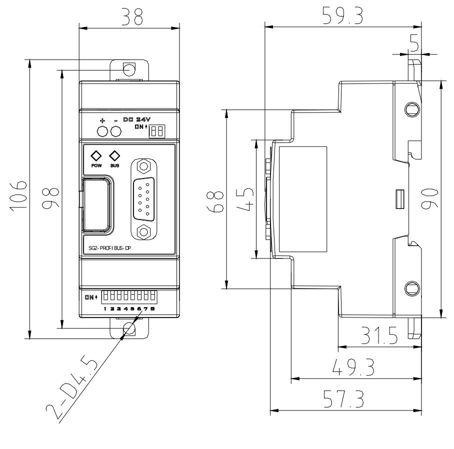


1.4 TP03 communication unit

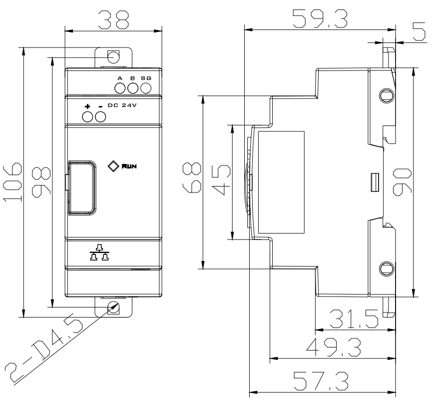
DNET



PBUS



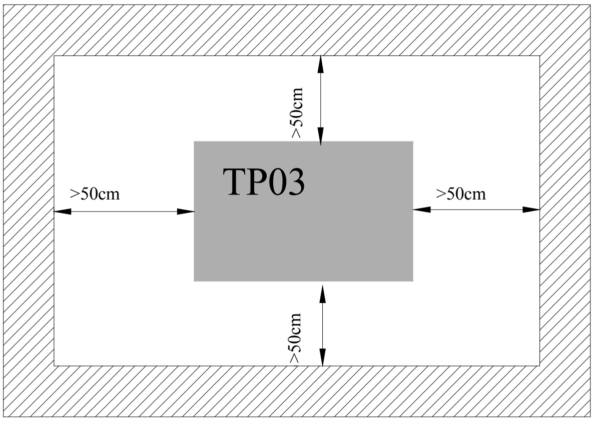
TCP-IP



2 Installation

2.1 Ambient environment

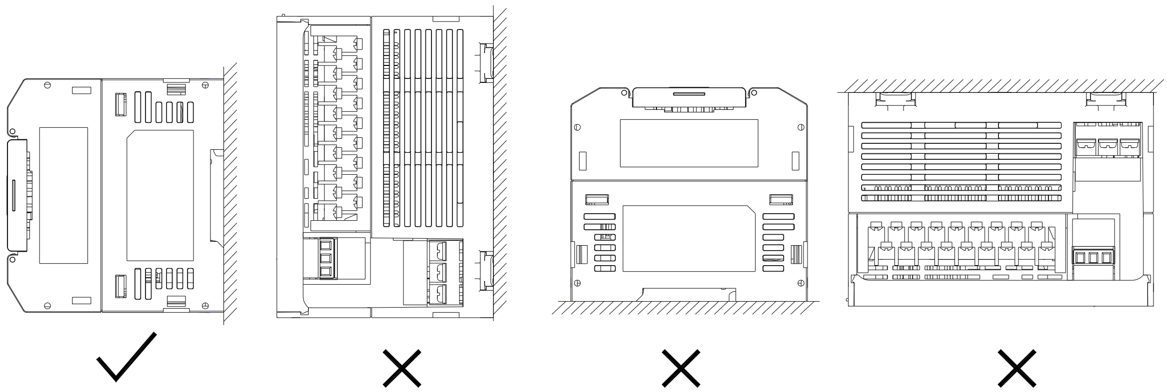
TP03 PLC should be installed in the closed-type distributor with sufficient space for dissipation (refer to following figure) in order to keep the PLC in good condition.



TP02 installation site should avoid following occasions:

- Ambient temperature exceeding 0 ~ 55 ℃, Relative humidity exceeding 5 ~ 90 % RH.
- Dusty, salty, iron powders place, corrosive, flammable, or ignescent gas.
- Exposed to volatile gas, detergent, ammonia gas, or electrolyte gas.
- Exposed to heavy vibration, possible shock, direct sunlight, poor ventilation and near heating device.
- Please keep the PLC far away from High voltage line, high voltage equipment, power line and radiation part of the radio aid, as well as large load switches.

2.2 Installation of basic unit and expansion unit



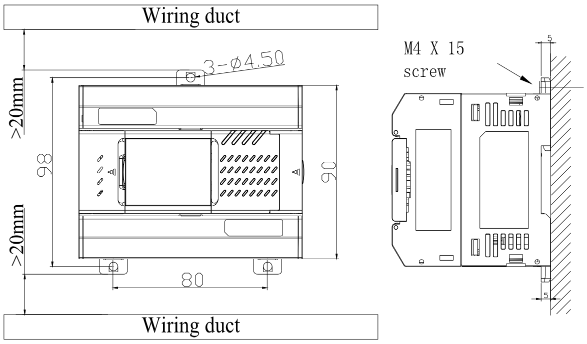
Chapter4 Dimension and installation

2.2.1 Directly installation

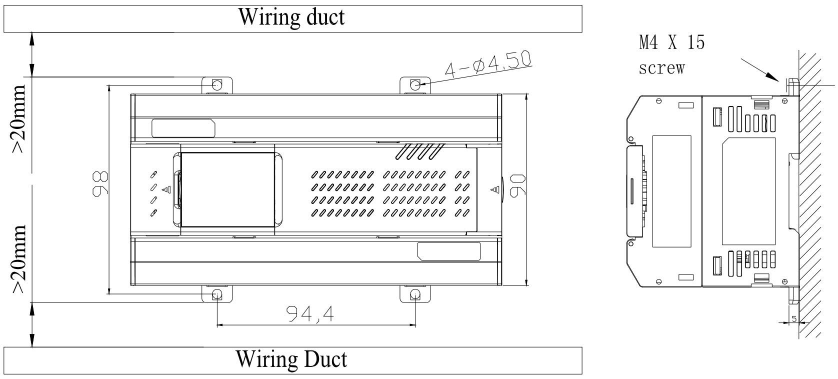
Please use M4 ×15mm or bigger screws to fix the PLC in the distributors.

When the expansion cable (4cm) is used, please refer to 6.1 for installation dimension and use M4 screws to fix the units.

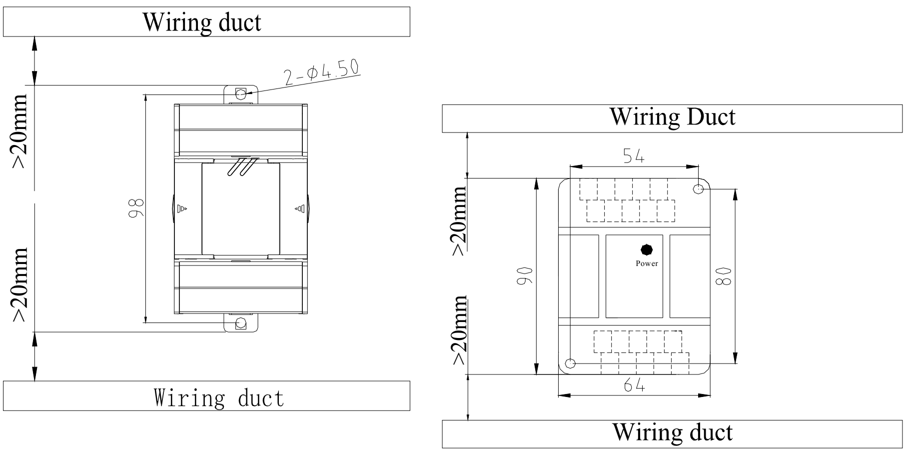
- Basic unit TP03-20□□-□/ TP03-30□□-□



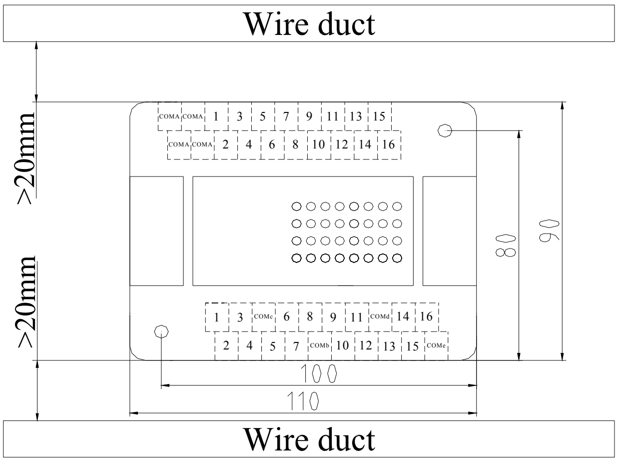
- Basic unit TP03-40□□-□/ TP03-60□□-□



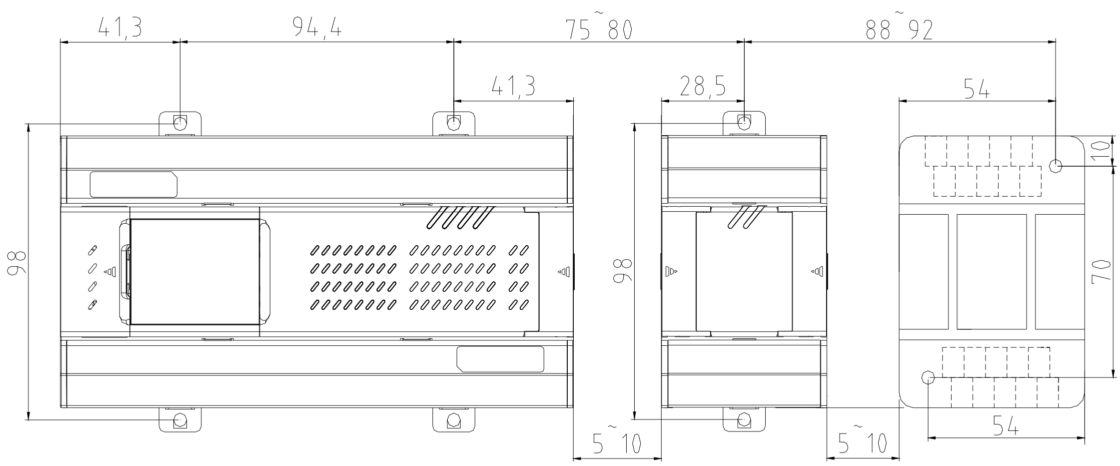
- Expansion unit

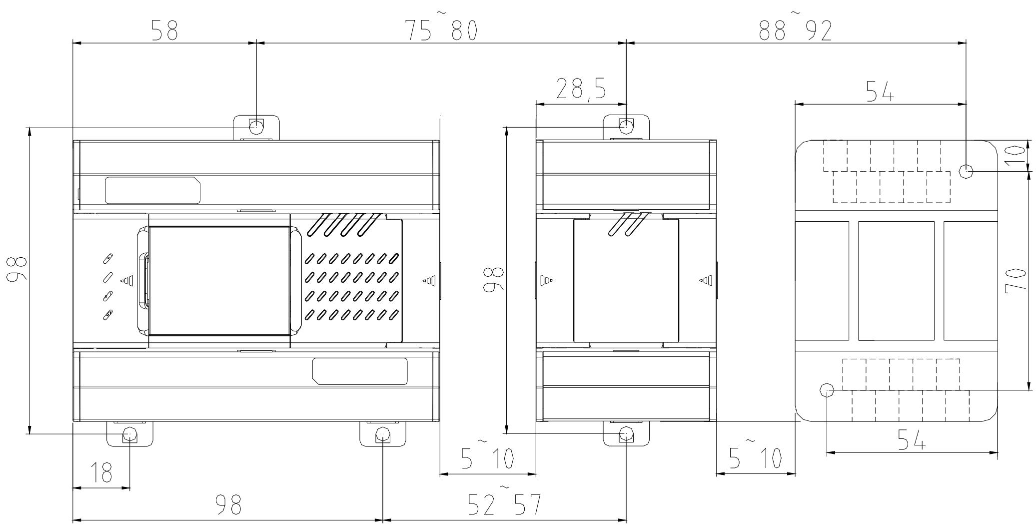


Chapter4 Dimension and installation



The following figure indicates dimension for installation holes when expansion cable (4cm) is used. And the fixing screw should be M4.



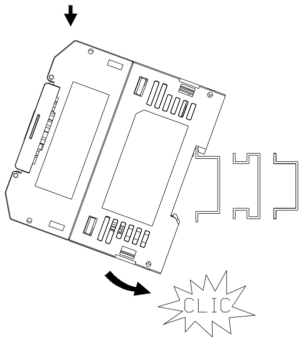


Chapter4 Dimension and installation

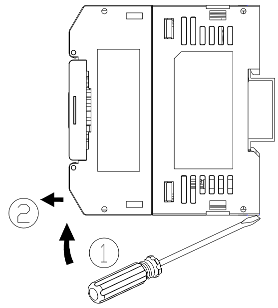
2.2.2 DIN Rail installation

Please user Din rail with width 35mm and mounting clamp for installing PLC

installing

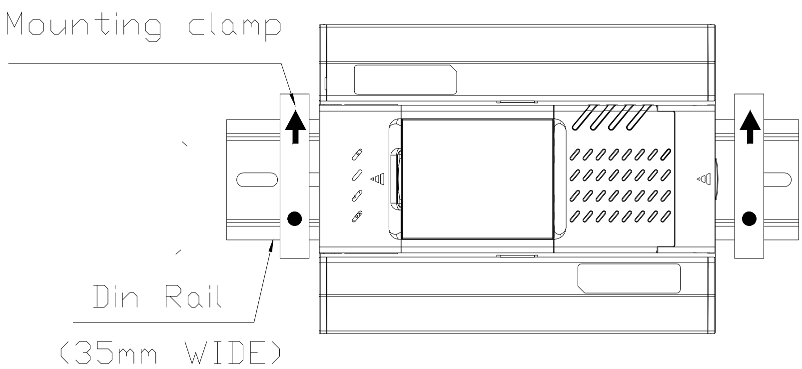


uninstalling



Firstly, place the groove at the back of modules right on the upper edge of Din rail. Then push the module down to lock up position. Retractable

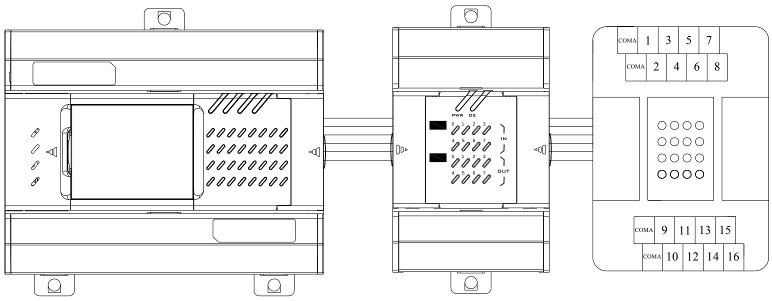
Pull out the retractable mounting feet. Then rotate the mould at the bottom to outside. The module will be uninstalled easily.



2.3 Installation for expansion cable and termination connector

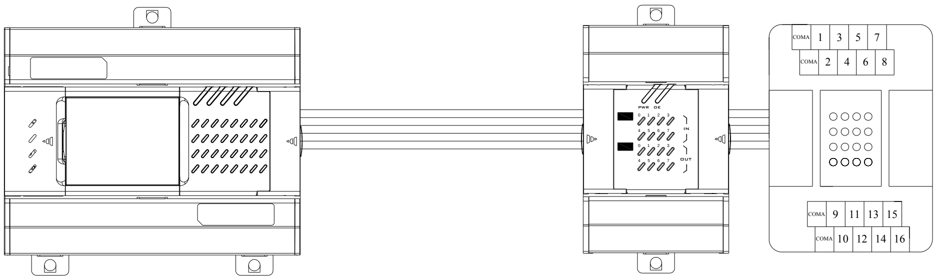
The expansion cable is used for expanding expansion modules. The expansion capability differs from different PLC types. Please refer to Chapter 2 for more information. Only one 400mm cable (TP03-340EC or TP-402EC) can be used in a expansion system. Others should be 40mm cable (TP03-304EC or TP-042EC). And the last unit should be installed with a terminal connector.

Example 1:

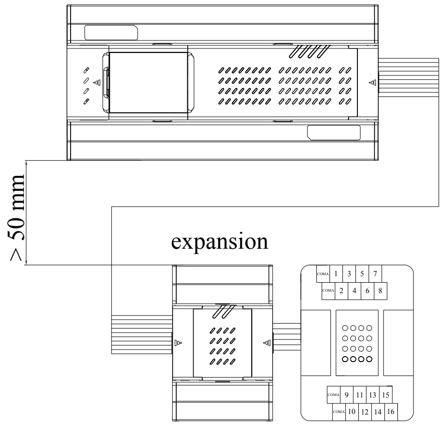


Chapter4 Dimension and installation

Example 2:



Example 3:



Before installing, please make sure the power is off.

Installing step for expansion cable and terminal connector:

(1) Open the expansion connector cover;

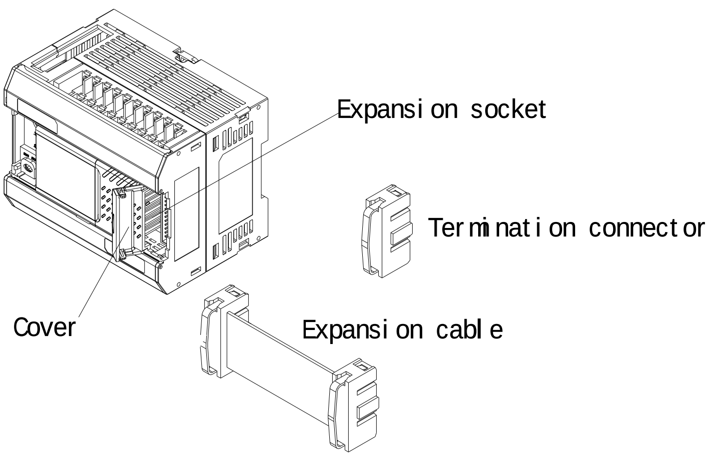
(2) Withdraw the termination connector originally installed the basic module at right side.

(3) Plug the expansion connector to the male connector on the module.

(4) Then, plug the other end connector to the male connector at left side of another module.

(5) And the termination connector should be installed in the last expansion module.

(6) Close the cover.



NOTE 1: Remove the expansion cable or termination connector from the expansion socket .

NOTE 2: Be ware of the (IN), (OUT) feature of expansion socket. They must be connected in correct order.

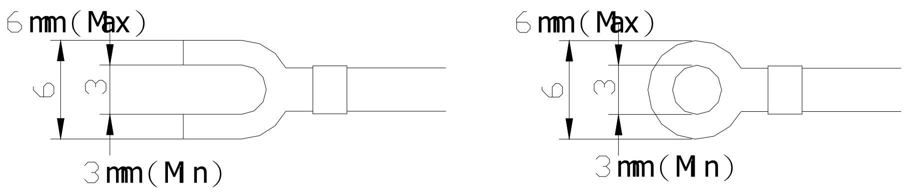
Chapter 5 Wiring

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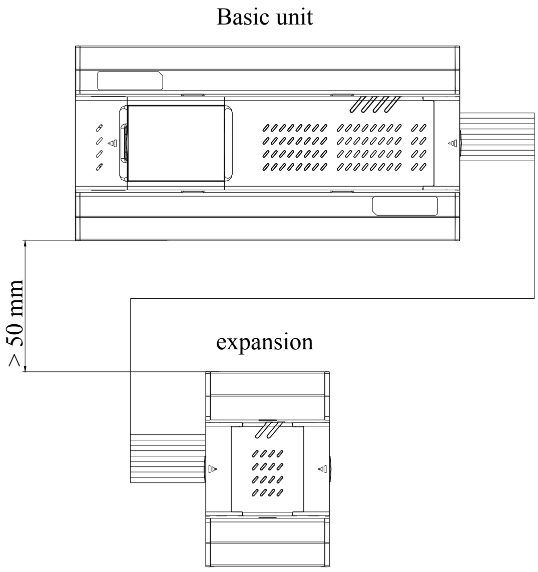
Chapter 5 Wiring

1 Wiring

◆ Please use the input and output signal wire with O or Y Ends (see figure below). The torsion torque should be 5~8kg-cm (4.3~6.9 in-lbs).



◆ Blank terminal should not be wired.
◆ Input and Output wire should not share same duct with power line, as well as use one several-strand cable for connecting both input/output signal and power.
◆ When PLCs are aligned in rows,



✧ The wiring for output/input signal of both basic and expansion units are susceptible to interrupting by noise. Thusly, the distance should be more than 50mm as above figure.
✧ The basic unit can expand more than two expansion units. Expansion cable should connect the right side of front unit with left side of next unit. All in all, the right expansion groove is for the next expansion unit or termination connector if there is no expansion unit any more.
✧ The standard expansion cable with the expansion unit is 40mm. And the longer cable 400mm is optional.

Precaution: The small conductor should not be allowed dropping into PLC when tightening the screw and wiring.

2 Basic unit wiring

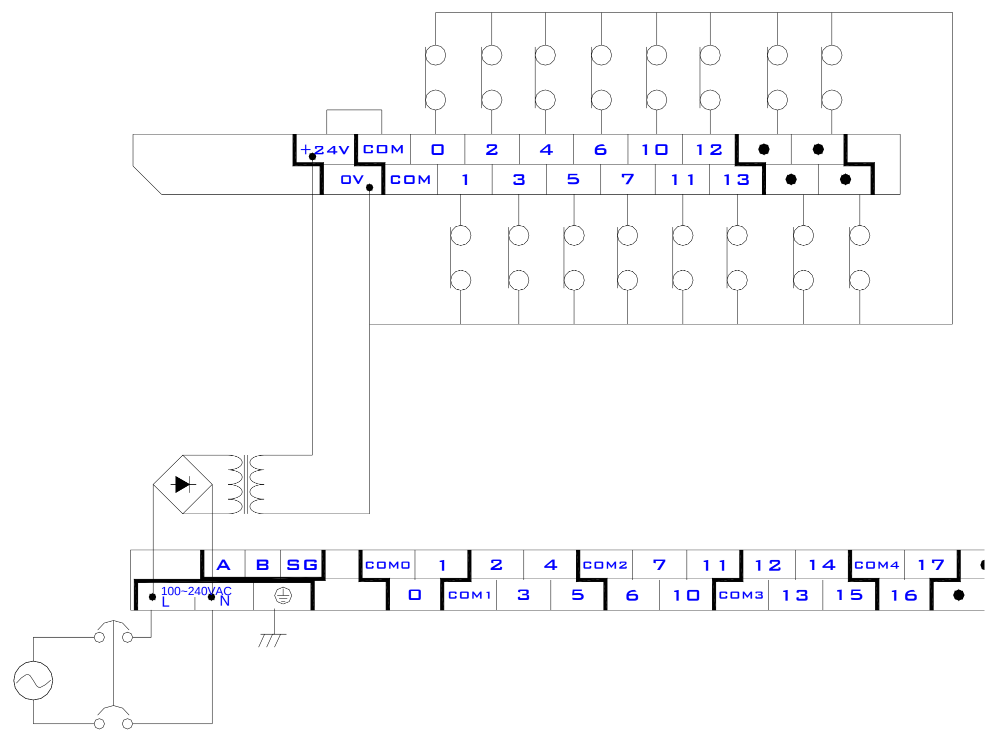
2.1 Wiring power supply and specification

2.1.1 Input wiring at power supply terminal

TP03 PLC is classified into DC and AC type. Please pay attention to following items.

For AC type:

- AC power range (100VAC~240VAC). Connect the power supply with L、N terminal on PLC. The PLC will be damaged if you connect the AC power to +24V terminal or input terminals.
- The power supply for both basic unit and expansion unit should be ON/ OFF simultaneously.
- The ground wiring for basic unit should not be less than 1.6mm.
- PLC would not be affected if the power fail lasted less than 10ms. The longer power fail or lower voltage will stop the PLC and cut all the output. And the PLC will recover operation as long as the power becomes normal. There are many retentive registers and relay for keeping the data during power fail. And the user should pay attention to that when in programming.

<table>
<tr>
<td>AC type</td>
<td>


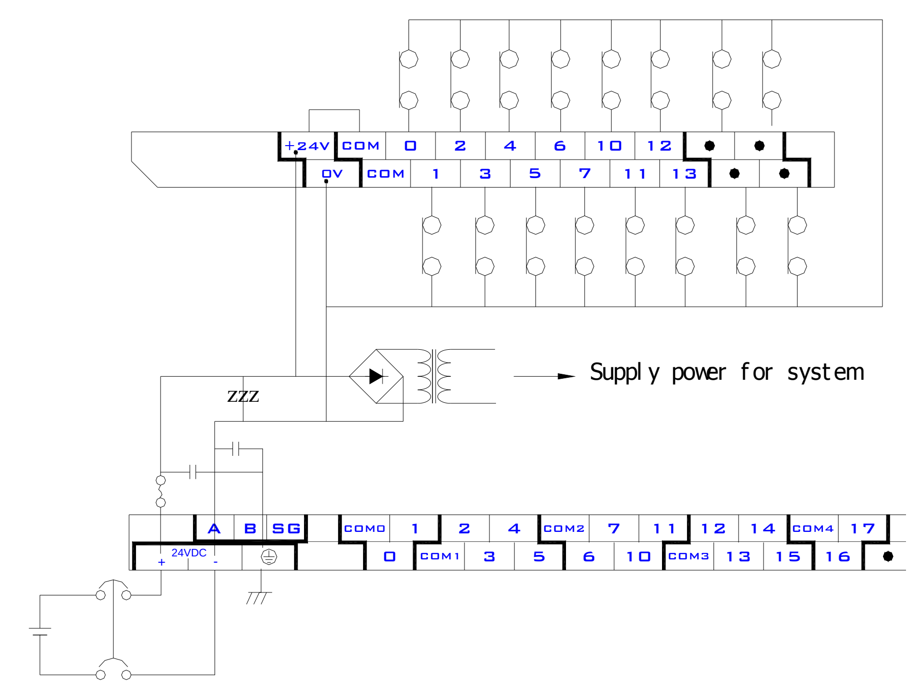
The max current for +24V terminal is 0.5A. External power can not connect with this terminal. Driving current for each input should be 6~7mA. For 16 inputs, the total current is about 0.1A. Thusly, the current for external load should be less than 0.3A.
The terminal +24V provides the driving current for transistor outputs Y0/Y1 in TP03 H type. The terminal COM0 connects with 0V, while others do not connects with 0V.
</td>
</tr>
</table>

Chapter 5 Wiring

For DC type:

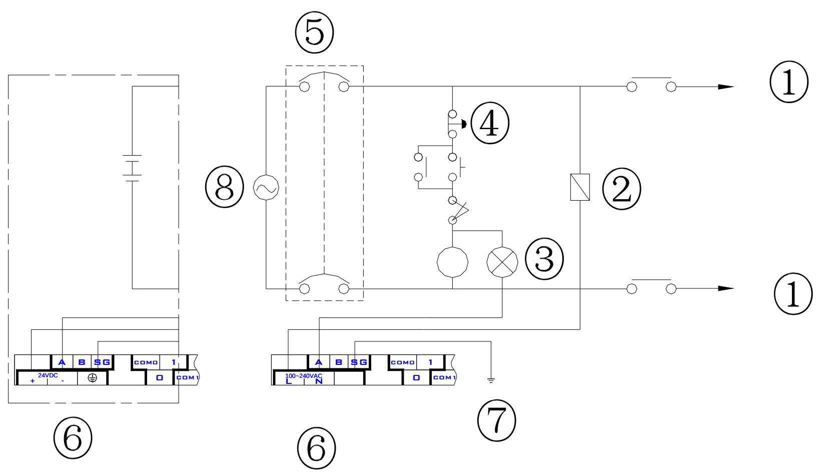
Please connect the DC power to 24V+ and 24V- terminal. Voltage range is 20.4VDC~26.4VDC. When the voltage decreases to less than 17.5VDC, PLC will stop and all outputs off.

DC type



2.1.2 Protection circuit:

Any device controlled by PLC is important in the system. Any fault will result in all the industry automation system out of control or in risk. It is recommended connecting a protection circuit to Power input.



①AC power supply load

②Fuse for protection circuit (3A)

③Power indicator

④Emergent stop switch

To cut off the power in emergent

⑤Isolation device of system

Isolation device can be a switch as MC or relay which can prevent the system from instability when in frequently ON/OFF the power.

⑥TP03 PLC Body

⑦ Third class ground

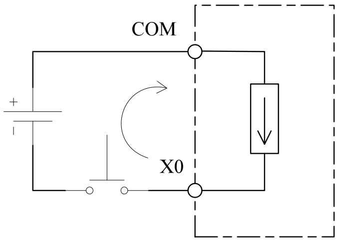
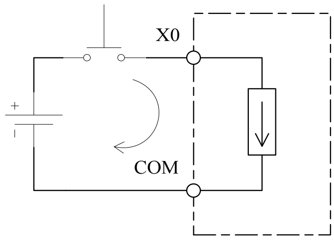
⑧Power supply：

(AC):100~240VAC, 50/60Hz

(DC):24VDC

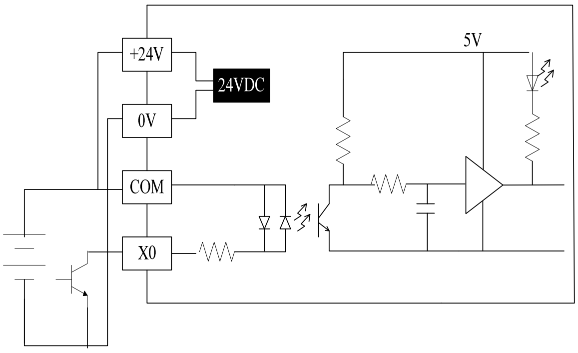
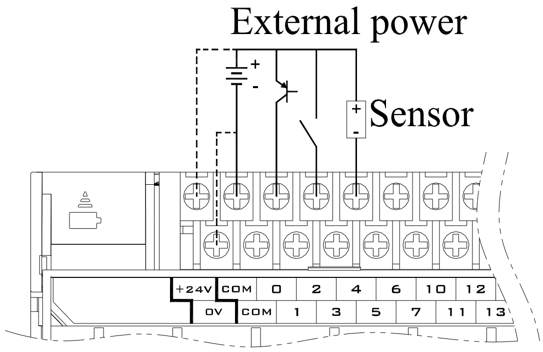
2.2 Input wiring

◎Input signal has two methods to be wired for DC input: SINK and SOURCE mode.

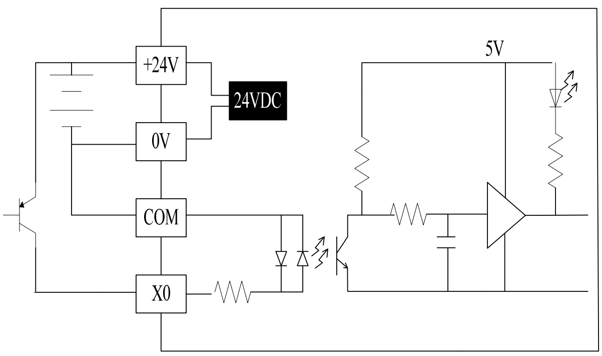
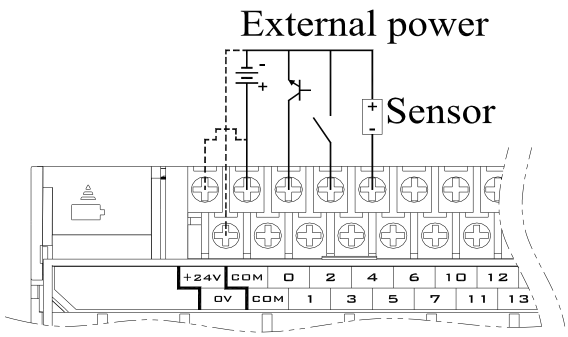
Sink = current inputs share the common	Source = Current outputs share the common
	

◎ Wiring

A. SINK mode

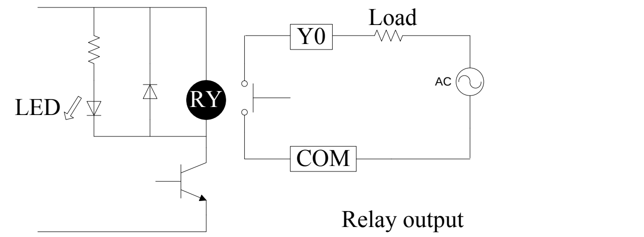
Input equivalent circuit.	Wiring circuit
	

SB. SOURCE mode

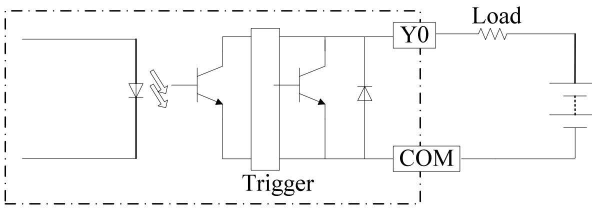
Input equivalent circuit.	Wiring circuit
	

◎ Insulation circuit: PLC internal circuit photo-coupling insulted with Input module.

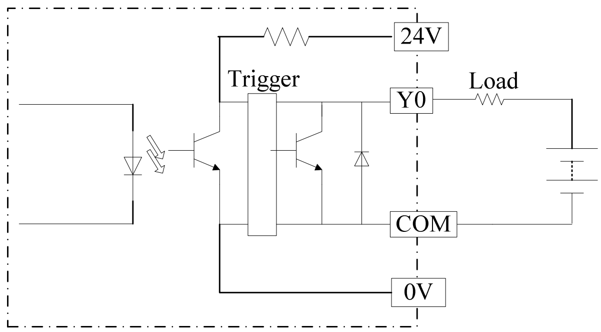
2.3 Output wiring



Relay output



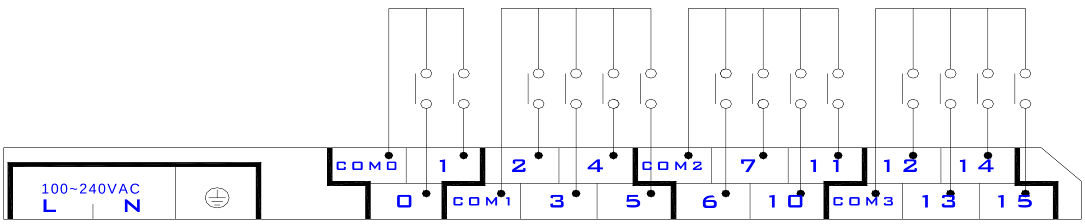
TP03 M transistor output



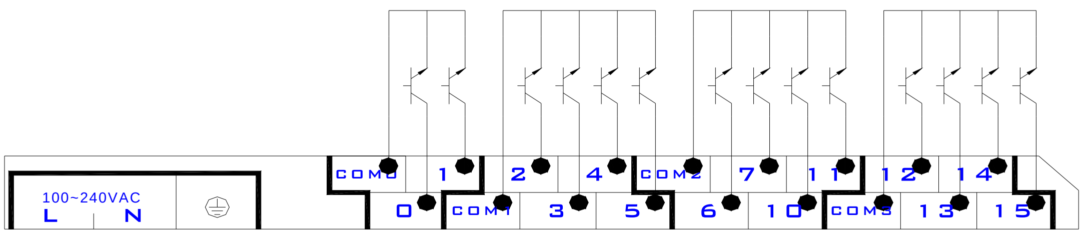
TP03 H transistor output

1. PLC Output has two types: relay and transistor. Please refer to chapter 2 for electric specification related to it.
2. Operation indicator: When the output is ON, the corresponding indicator will be lit.
3. Insulation circuit:
For transistor output:
PLC internal circuit is photo-coupling insulated.
For relay output:
PLC internal circuit is relay insulated.
4. Please pay attention to common terminal's wiring for output. Take TP03-30MT-A as an example, Y0~Y1 share COM0, Y2~Y5 share COM1, Y6~Y11 share COM2 and Y12~Y15 share COM3. See the following figure for transistor output type.

For relay output:



For transistor output:

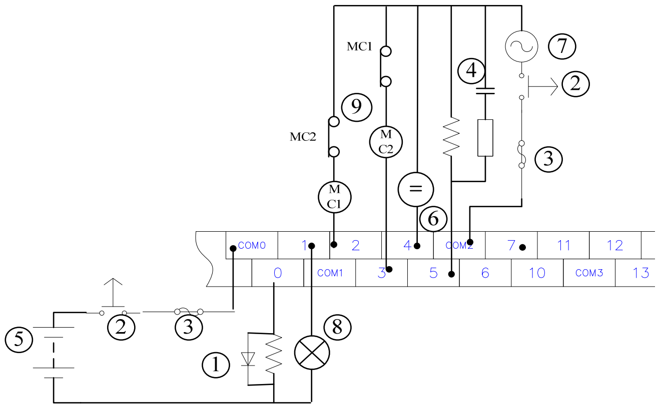


Chapter 5 Wiring

Over load capacity for output terminal

Each output terminal has the overload capacity of 2 times of rated current/ 5Min and the common terminal has 1.5 times of rated current/ 2Min. If that exceeds limited range, the terminals will be fault or even the internal circuit will be dangerously burned.

◆ Wiring example for Relay output type



①Diode for absorbing surge: to extend the terminals lifespan.

②Emergency stop: use external switch

③Fuse: connect the fuse at output common terminal with the capacity of 5~10A in order to protect output circuit.

④Surge absorber: to reduce the noise from AC load

⑤DC power supply

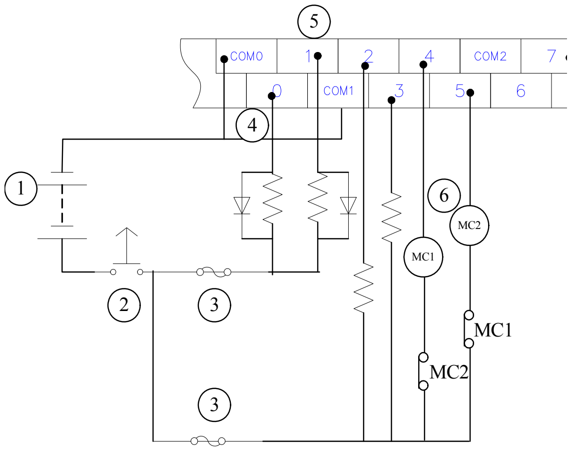
⑥Indicator: neon lamp.

⑦AC power supply

⑧Incandescent lamp (resistance load)

⑨Mutually locked Output: to connect an external mutually locked circuit matching with PLC internal program to provide safety protection for any exceptional condition.

◎Wiring example for Transistor output type



①DC power supply

②Emergency stop

③Fuse for protecting circuit

④All outputs for transistor type are Open Collector. If Y0 is set to pulse output (PLSY instruction), please connect a resistor to maintain the output current >0.1A in order to ensure output normal operating.

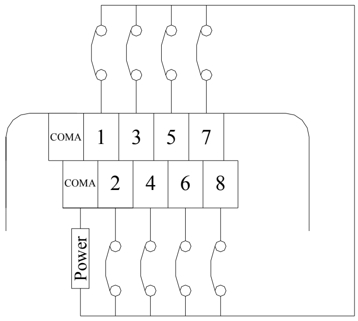
⑤All outputs for transistor type are Open Collector. If Y1 is set to pulse output (PWM instruction), please connect a resistor to maintain the output current >0.1A in order to ensure output normal operating.

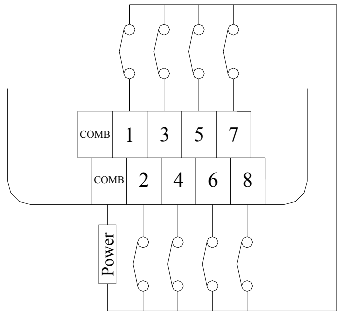
⑥Mutually locked Output: to connect an external mutually locked circuit matching with PLC internal program to provide safety protection for any exceptional condition.

3 Expansion unit wiring

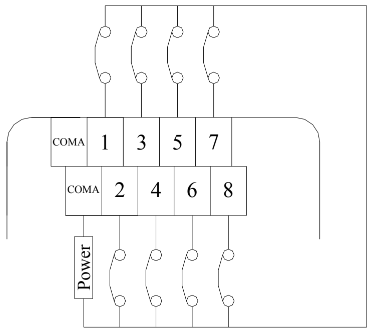
3.1 Input wiring for expansion unit

TP02-16EXD

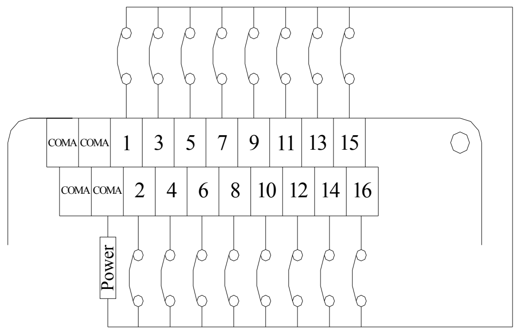




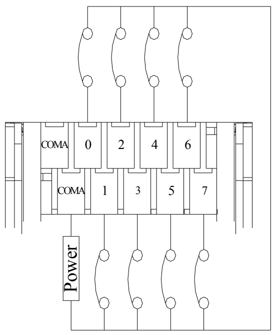
TP02-16EMR

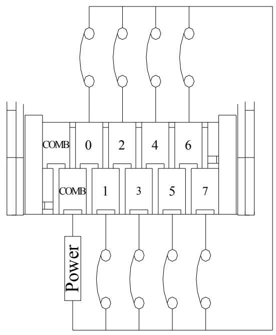


TP02-32EMR

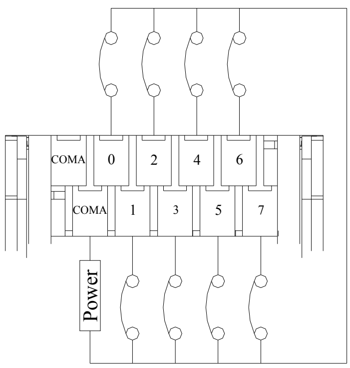


TP03-16EXD



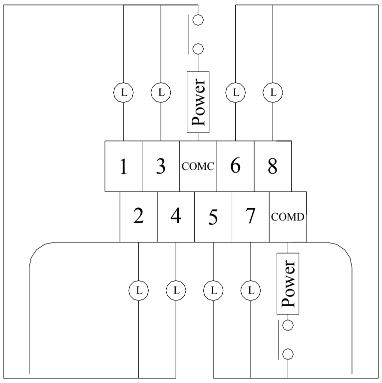


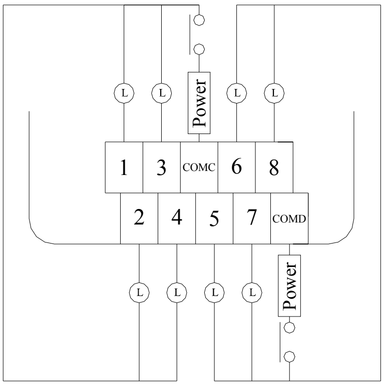
TP03-16EMR/TP03-16EMT



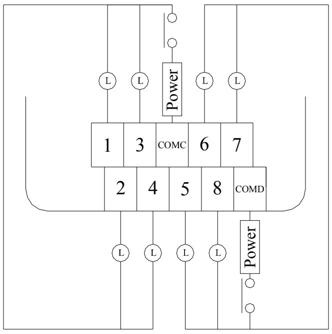
3.2 Output wiring for expansion unit

TP02-16EYR / TP02-16EYT

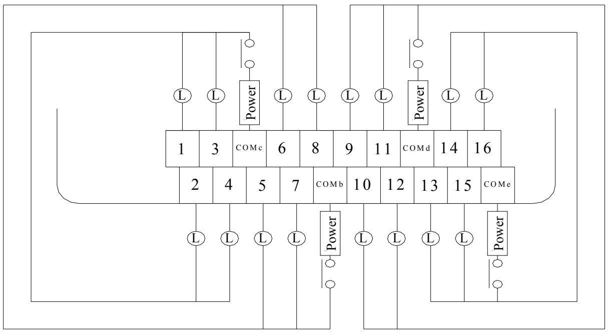




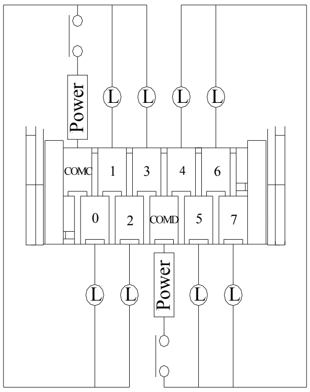
TP02-16EMR

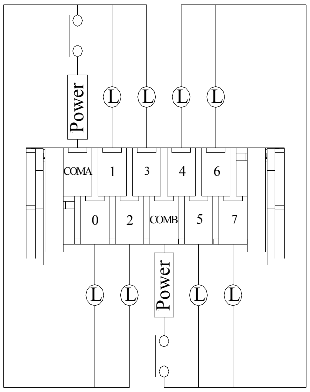


TP02-32EMR

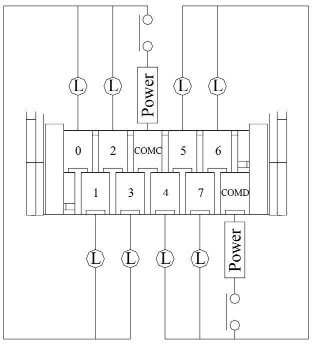


TP03-16EYR/ TP03-16EYT





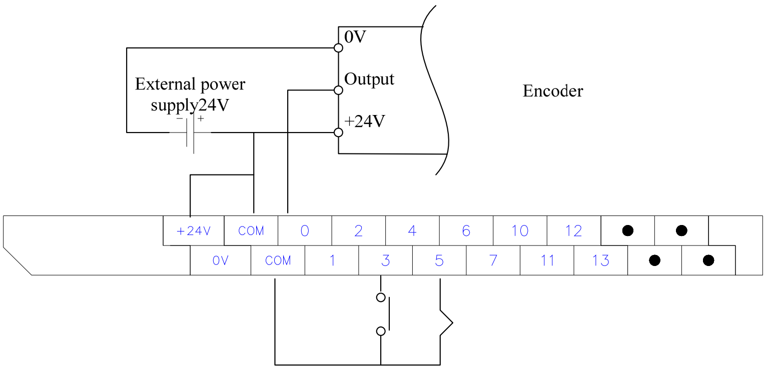
TP03-16EMR/TP03-16EMT



4 Wiring consideration

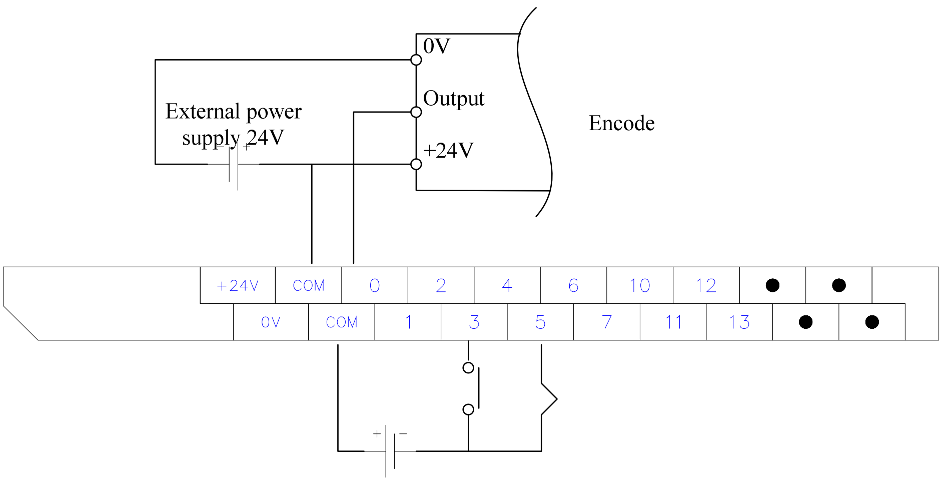
4.1 Wiring consideration for Input power terminal

4.1.1 When Built in DC24V power supply share Common terminal with External power



Note: External DC2V + terminal can connect with the COM on the PLC, while – terminal must be separated.

When external DC24V power supply share Common terminal:



Note: All external power DC24V + terminals can be connected with the COM, while – terminal must be separated.

4.2 Wiring consideration for Input terminal:

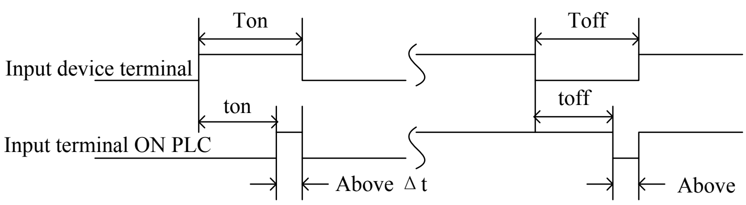
Input ON/OFF duration must be following the principal to ensure the correctness of signals:

Ton>Δt + ton Toff<Δt + toff .

Input ON duration: Ton *Module responding time for OFF—ON: ton*

Input OFF duration: Toff *Module responding time for OFOFF—ON: toff*

PLC a scan time: Δt

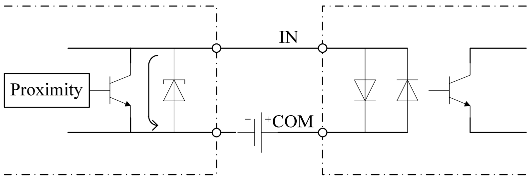


Chapter 5 Wiring

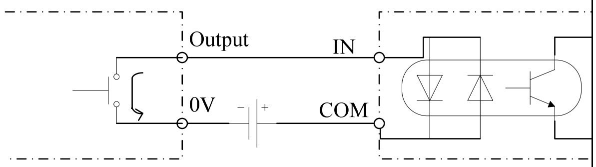
4.2.1 Wiring consideration for different Input devices (sensor/ switch…)

DC input

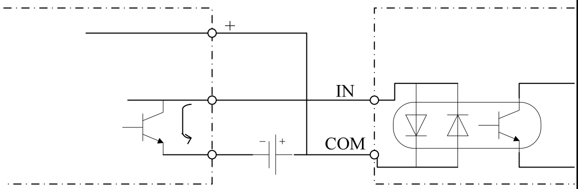
Example 1 · DC 2 wires type (proximity sensor):



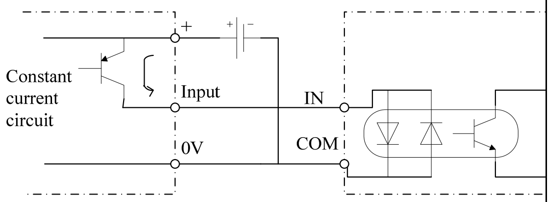
Example 2 · Contact output type



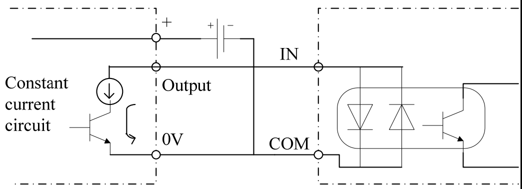
Example 3 · NPN open collector type



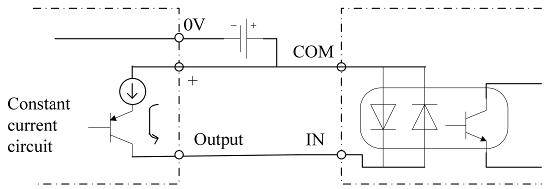
Example 4 · PNP open collector type



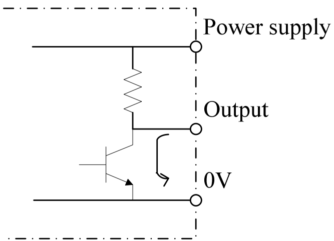
Example 5 · NPN current output type



Example 6 · PNP current output type



Example 7. Voltage output type



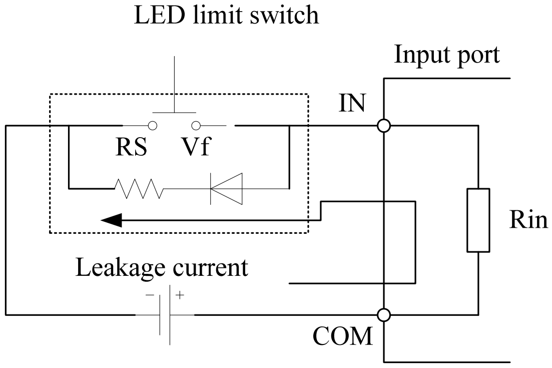
Among the above example 1, 2, 3, 4, 5, the driving current of external output transistor must be larger than that of internal transistor of input module (6～7mA).

As for example 1, please pay attention to leakage current as OFF (if that is larger than OFF current, the OFF action will not be operated).

As for example 7, the component of voltage output type can not be used in TP03 DC input.

4.2.2 Leakage current of Input component

AS for the following example, when there is leakage current as signal OFF, and larger than the module OFF current, the module can not OFF or Onise margin will not work as module is OFF.



<Reference >

Formulation for leakage current

$$iL = \frac{V - Vf}{Rin + Rs}$$

V: Power voltage

Vf: voltage drop on LED.

Rs: resistance of current limit

Rin: internal impedance of input module

Refer to the circuit diagram of the solution eliminating the effect of leakage current, the resistance of R should comply with the following formulation.

$$\because iL \times \left(\frac{Rin \times R}{Rin + R}\right) < VinOFF$$

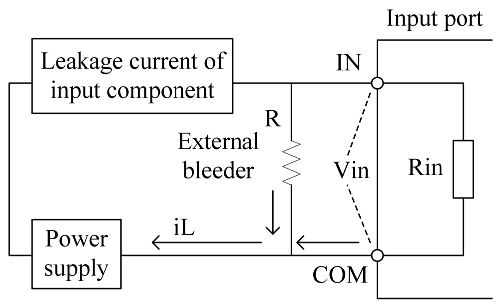
$$\therefore R < \left(\frac{VinOFF \times Rin}{Rin \times iL - Vinoff}\right) \times toleranceA$$

Tolerance A: 0.7

Power for bleeder resistor:

$$W > \frac{V^2}{R} \times toleranceB$$

Tolerance B: 1.5



iL: leakage current

Vin OFF: Off level for input signal

Rin: Internal resistor of input

V: Power voltage

For example: basic unit TP03-30MR, power supply voltage=24V，VinOFF=15V, Rin=3.5kΩ.
given leakage current for input component = 6.5mA。
That is iL=6.5mA, Vin OFF=15V, Rin=3.5kΩ, V=24V

$$R < \frac{15 \times 3.5}{3.5 \times 6.5 - 15} \times 0.7 = 4.75k\Omega$$

R=4.75kΩ , if standard resistor R=4.7 kΩ. then

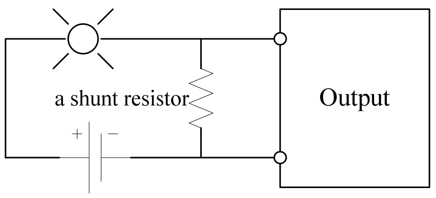
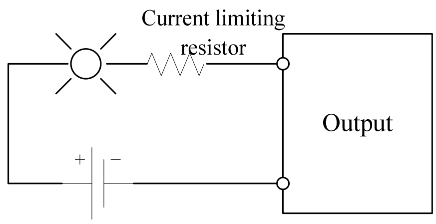
$$W > \frac{24^2}{4.7k} \times 1.5 = 0.18W$$

A resistor 4.7kΩ with power 1/4W should be applied as the bleeder resistor.

4.3 Output terminal wiring consideration:

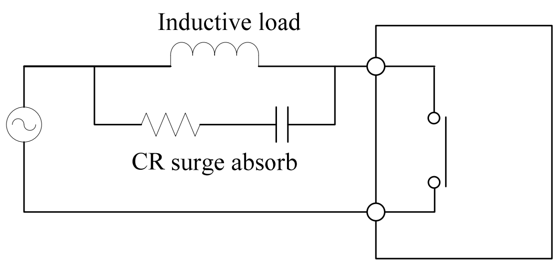
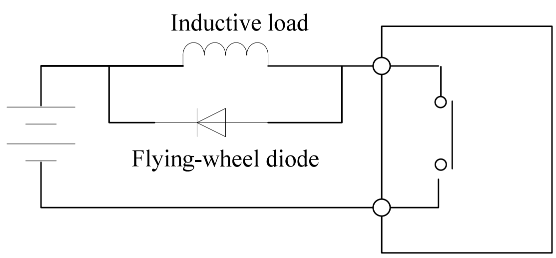
4.3.1 Surge current from Indicator load:

When the incandescent lamp is turned on, there will be a surge current 10~20 times larger than normal value lasting some 10ms. It is recommended to add a shunt resistor or a bleeding resistor to reduce that surge.

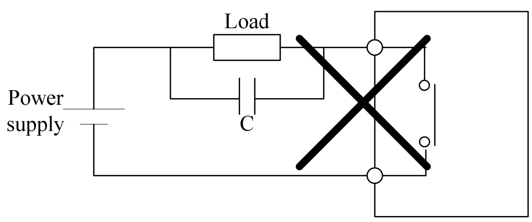
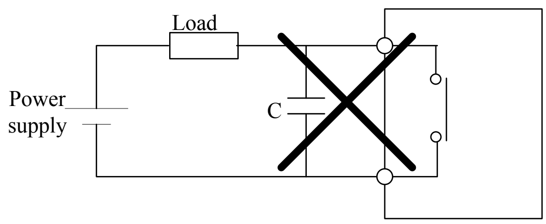
A shunt resistor	Current limiting resistor
	
There will remain current to supply for indicator in OFF condition, therefore, the resistance should be carefully determined.	The brightness of the lamp will be reduced if the resistance is too large.

4.3.2 Surge voltage of inductive load

When inductive load is ON/OFF transited, there will be a surge voltage KV. Particularly, relay output module has no standard surge absorber, so it might be seriously affected by such surge voltage. Please refer to following directions regarding surge absorbing for different circuit.

As for AC power supply type, please apply a CR surge absorber.	As for DC power supply type, please apply a flying-wheel diode surge absorber.
	

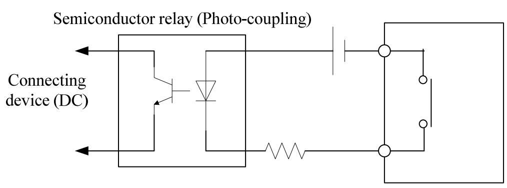
Applying single capacitor to absorb surge may seriously damage relay terminals! (Please do not apply that).

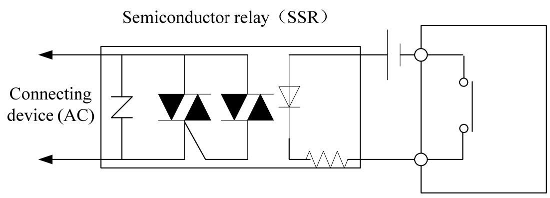
	

The charging current of capacitor in OFF condition is too large, so the terminal might be melt. While short circuit current of capacitor in ON condition, the terminal also might be melt out.

4.3.3 Driving a light load

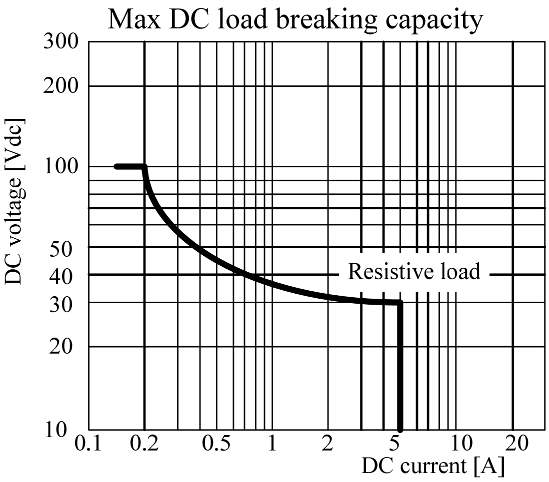
A semiconductor relay can be applied as an interface to drive a light-loaded machine.

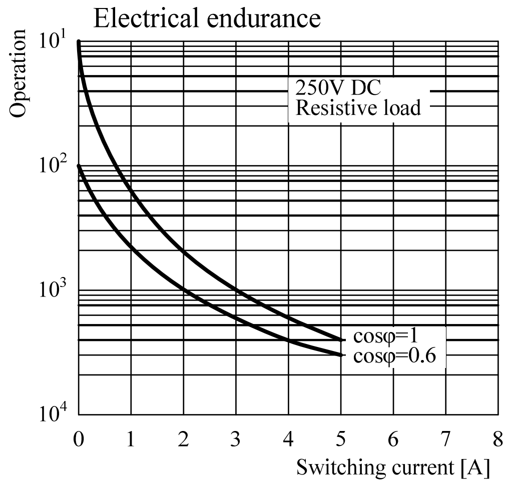




4.3.4 Lifespan of relay

The lifespan of output relay varies with different loads.





Note 1: The data in the figure are rated ones. The ambient temperature will affect the lifespan of relay.

Note 2: Mechanical lifespan of the relay will be over 200 million times.

Note 3: Generally, the lifespan of relay could be over 100,000 times as the current is within 2A.

4.3.5 Wiring consideration for TP03 HT type PLC

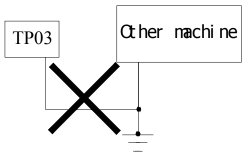
When using TP03 HT type PLC(TP03-20HT-A,TP03-30HT-A,TP03-40HT-A,TP03-60HT-A),the output terminal Y0 and Y1 share one common terminal COM0,the COM0 and USER 0V are connected internally in TP03 PLC. Be sure not to connect USER 24V and COM0,the other COM and USER 0V are not connected internally in TP03 PLC.

5 Solving noise problem

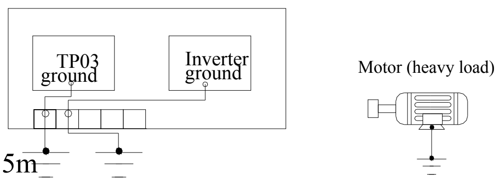
The wiring between PLC and external device will result in external noise affecting PLC system. Here is the noise immunity resolution for different application.

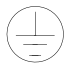
Grounding

PLC should be separately grounded. Particularly, it should not be grounded together with other heavy load (including inverter or motor).

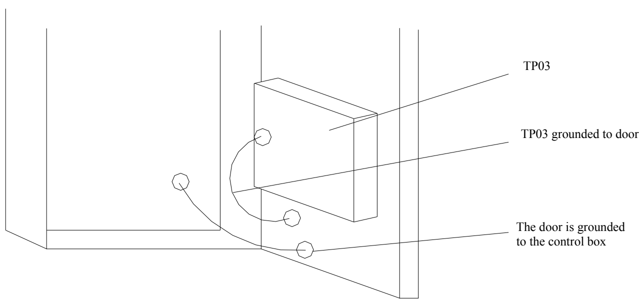


Apply Class 3 ground for TP03. The grounding wire should be $2mm^2$ or more and less than 5 meters in length.



If the system can not be grounded separately, just connect the  terminal of TP03 to the distributing box as shown in figure. The connecting wire should be as short as possible. If the distributing box has been grounded, it is not necessary to connect the grounding terminal of TP03 to the distributing box.

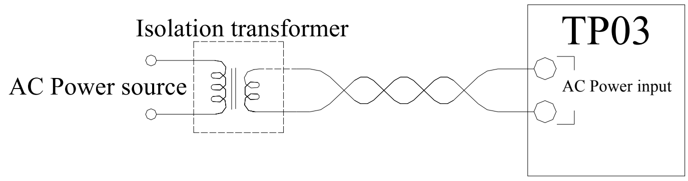
If TP03 is installed on the door side of distributing box, please wire the grounding as shown in following figure. (Apply grounding wire with diameter exceeding $2mm^2$ and length within 50cm).



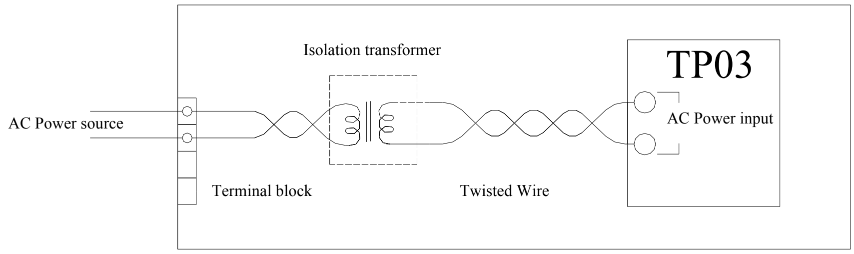
5.1 Power source noise

The noise immunity of TP03 power module is 1000Vp_p. when the noise is larger than that, please add isolated transformer at power side to absorb high frequency noise (100KHZ~2MHZ).

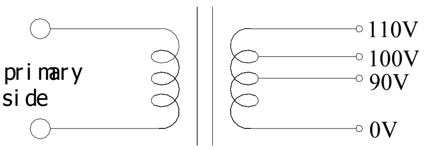
Chapter 5 Wiring

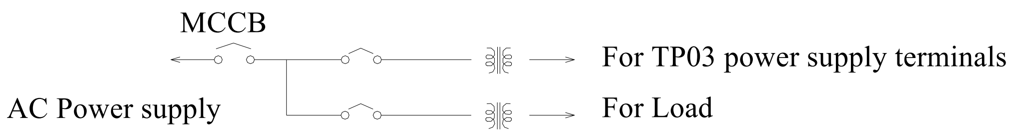


The closer the isolation transformer located to PLC input, the better. AC power wire should be twisted wire. The capacity of isolation transformer should be more than 120% consumption capacity of PLC, or the voltage at primary side of transformer would larger than rated one that will undermine safety.



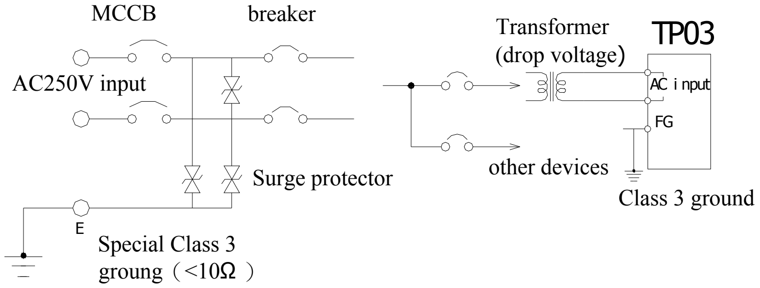
Please add a voltage tap to secondary side of transformer if the capacity of transformer is larger.
The power supply for PLC should be a single one when noise is very serious. And several transformers are recommended.



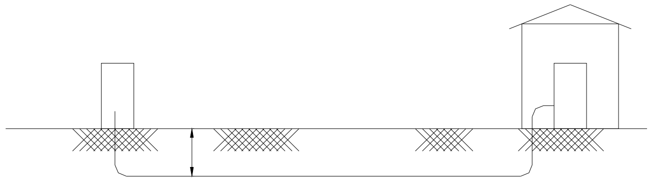


5.2 Solving thunder stroke problem

When the factory installing PLC is far away from other buildings, the installation of PLC must take thunder stroke problem into consideration. (Thunder stroke may induce surge voltage up to 4000KV). A surge protector must be installed to reduce the high voltage and protect PLC. It is recommended to install a surge protector according to the equipment installed and power capacity. Please refer to following diagram for the installation of and outdoor 1.7KAV surge protector.



The special type 3 ground (resistance less than 10ohm) must be installed separately with PLC ground.
Applying underground pipeline may isolate the voltage induced from the air. (Under thunderbolt, the voltage induced from the air may be exceeding 24 VDC.) The pipeline should be buried underground in depth at least 60 cm.



60cm or 120cm depth under ground

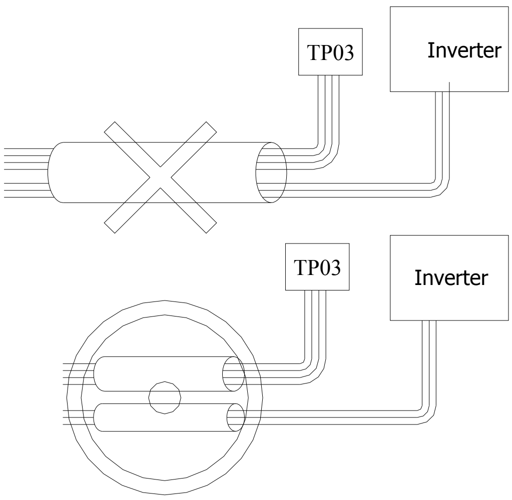
Applying relay to input/output signal wire may isolate induced voltage and protect the PLC from damage.

5.3 Anti-Noise for Expansion Cable

If an elector-magnetic switch is operating ON/OFF action near the PLC or expansion cable, it is possible to generate messy noise or high voltage and cause undesired effect to the PLC. Please install surge protector beside the elector-magnetic switch. The system expansion cable must not be placed into the same wiring duct with any other input/output signal or power line.

5.4 Anti-Noise for I/O Wiring

Please apply insulated twisted pair to be input signal line to prevent noise interference. Shielding wire of insulated twisted pair should be connected to the FG terminal of TP03 and then to the ground. Please refer to “Precautions for connecting output terminals” for information.
Surge Absorber is not included in the output circuit of relay output module. Please apply additional surge absorber in operation.
Power lines should be arranged away from input/output signal line and communication wire to prevent noise interference.
In case the signal connection distance of input/output wire is longer, input wires should be wired separately to the output wires to prevent noise interference.
Never wire the signal lines of PLC to the same wiring duct of any other power line.



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Chapter 6 Trial Run

1 Trial run

1.1 Before Trial run

When TP03 installing and wiring finished, check the following points before Power ON.

Step	Check item	Points to check
1	Check installation condition	● Is the TP02 expansion module wired in the end? ● Is the product type right? ● Is the TP03 installed on vertical surface of control panel? ● Whether each module is fixed securely ● Whether there is sufficient space for dissipation
2	Check power lines, input/output lines and communication lines	● Whether the wiring is correct?(Power, input/output lines) ● Whether the screw in the terminal block is loosing? ● Whether the cable AWG is proper? ● Are power lines twisted? ● Whether input/output lines run parallel or close to high voltage /high current lines? ● Are output lines equipped with protection fuses? ● Are shielded twisted pair cables used for communication lines？
3	Check expansion cables and termination connector	● Is number of expansion cables (number of expansion modules) used appropriate? ● Are more than two 40CM strand cables used? ● Is a termination connector installed on the last expansion module?
4	Check the grounding line	● Whether Class-3 grounding is correctly grounded? ● Whether the grounding is not connected together with high voltage board?
5	Check the voltage of power supply	● Whether the power source is correct (AC or DC)? ● Whether the polarity of power is correct (AC: L / N, DC: +/-)? ● whether source voltage is within rated voltage (AC: 85~250V, DC: 21.6~26.4V)?
6	Check the operation condition of the pause output circuit	● Whether there is proper safety external protection circuit for PLC?
7	END	

1.2 Trial run step

Step	Action	Details
1	Write program	Run PDA06/PC06 to design program on PDA/PC including ▪Setting system memory (D8321) ▪Design program ▪Save the designed program
2	Link PDA/PC with PLC	
3	Supply power	▪Whether the POWER indicator is ON? ▪Whether the RUN indicator is lit. Please switch the RUN/STOP to STOP. ▪Whether the BAT indicator is ON? Not ON is right. ▪Whether the ERR indicator is ON? Not ON is right. ▪If either BAT or ERR indicator is on, please refer to troubleshooting.
4	All initialize	With PDA/PC to initialize TP03 and write program to it.
5	Check the wiring to I/O	▪Check the input wiring with input indicator or the monitoring device? ▪Check the output port wiring by forcing set/reset of the output relay with auxiliary device.
6	Trial run	▪Check whether the Run indicator is ON?
7	Modify the program	▪Modify the program online, if it is not proper.
8	Save the program	▪Save the program in PC other device can store it. Record type of PLC, program capacity, facility name and date. ▪Printout the program.
9	End	

2 Maintenance and Inspection

2.1 Periodical inspection

Please refer to following tables to periodically inspect TP03 in order to keep it in best operation condition.

2.1.1 General items:

Inspection item	Check up	Criterion	Remark
Ambient temperature	Refer to installation precaution (ambient temperature should be the one inside the distributor)	0~55℃	
Ambient humidity		5~90%RH	Non-condense
Gas		No corrosive gas	
Vibration immunity		No	
Shock immunity		No	

2.1.2 Basic unit:

Inspection item	Check up	Criterion
Power supply voltage	Measure the input voltage of power supply on the terminal block. Whether it is within specified range?	AC type: AC100~230V DC type: DC21.6~26.4V
Actual voltage of DC24V terminal on AC type	Measure voltage of DC24V terminal on the terminal block. Whether it is within specified range?	DC21.6~28.8V (Voltage could be 30VDC as PLC has no load)
RUN/STOP Switch	Whether it is in right position	In RUN position
Input terminal voltage	Measure voltage of input terminal on the terminal block. Whether it is within specified range?	DC19.2~26.4V
Output terminal voltage	Measure voltage of output terminal on the terminal block. Whether it is within specified range?	For relay output type: Less than AC 250V Less than DC 30V For transistor output type: Less than DC 30V
Err indicator on basic unit	Eyeballing ERR indicator	OFF
Installation condition	Basic unit is fixed or not?	No loose
	Screws on terminal block are loose or not?	No loose
	The withdrawable terminal is loose or not?	No loose
	Expansion cables, termination connector are all installed proper or not?	Installed
	The expansion card is loose or not?	No loose

2.1.3 Expansion units:

Inspection item	Check up	Criterion
Input terminal voltage	Measure voltage of input terminal on the terminal block. Whether it is within specified range?	Please refer to specification of each unit.
Output terminal voltage	Measure voltage of output terminal on the terminal block. Whether it is within specified range?	
Installation condition	Expansion unit is fixed or not?	No loose
	Screws on terminal block are loose or not?	No loose
	Expansion cables, termination connector are all installed proper or not?	Installed

3 Troubleshooting

Please check the indicators on basic units as error occurs. And do troubleshooting according to different conditions.

3.1 LED indicator status

M,H type

PWR	RUN	BAT	ERR	Description		
OFF	OFF	OFF	OFF	Power is OFF	→	Troubleshooting procedure – 2
ON	BLINK / ON	OFF	ON	Self-diagnosis detects error that program does not operate and all I/O does not work.	→	Troubleshooting procedure – 1
ON	BLINK	OFF	OFF	Stop mode	→	Troubleshooting procedure – 3
ON	ON	OFF	OFF	RUN mode	→	Input state error: Troubleshooting procedure – 4 Output state error: Troubleshooting procedure – 5
ON	ON	OFF	BLINK	A warn for the program is logically error. Both program and I/O still in working.	→	Check the logic of user program. / troubleshooting procedure – 1
ON	ON	ON	ON	Other	→	Troubleshooting procedure – 1

S type

PWR	RUN	Description		
OFF	OFF	Power is OFF	→	Troubleshooting procedure – 2
ON	Shine slowly(6.4s)	Self-diagnosis detects error that program does not operate and all I/O does not work.	→	Troubleshooting procedure – 1
ON	Shine quickly(1.6s)	Stop mode	→	Troubleshooting procedure – 3
ON	ON	RUN mode	→	Input state error: Troubleshooting procedure – 4 Output state error: Troubleshooting procedure – 5
ON	ON	Other	→	Troubleshooting procedure – 1

3.2 Presumption of troubleshooting procedure

Such troubleshooting procedure is to resolve abrupt error and recovery method after the error module was superseded by a good one.

The following conditions are not included:

a. Temporary error caused by noise interference (not successive)

b. Problem caused by faulty program (User application)

3.3 Preparation for troubleshooting

a. Backup the program memory and system memory.
The auxiliary device could not save current program or save the wrong content sometimes. Please save the latest program and system memory to PC.
Please also save the necessary data to PC as in ROM operation mode.

b. Auxiliary device
Prepare PC / PDA and etc.

c. Spare units
Prepare necessary replacement for faulty units

d. System memory setting recorder and I/O relay assignment lists.
Please prepare ‘system memory setting recorder’ and ‘I/O relay assignment lists’.

3.4 Check the following again

- Power indicator
  The red indicator for POWER will be on as the main unit/ expansion unit is supplied with power. If it is off on main unit, maybe it is caused by the heavy load of built-in DC24V on TP03. Please unload it, and prepare with external power supply DC 24V.
- Preparation
  - Please check the wiring for input/ output and power. If AC220V is supplied to input/ output terminals, the TP03 body will be damaged.
  - After send the user program (programmed by PC/ PDA) to TP03, check the ERROR indicator. If the ERROR indicator does not blink, that means the program is right. And the program can be trial run then.
  - It is available for user to enforce terminal ON or OFF with PC/ PDA to inspect wiring.
- Run and supervision
  PC/ PDA can supervise the set value and present value from Timer, Counter, Data register and enforce the output ON/OFF.。
- PLC input/ output responding time

Responding time for PLC from sending input signal to input terminal to output signal: Responding time = Delay for input port +Scan time for operating user program+ Delay for output port

<table>
<tr><td colspan="2">Delay time for general input terminal</td><td>2.5ms, can not be adjusted.</td></tr>
<tr><td colspan="2">Delay time for Interruption or high speed signal</td><td>10us, can not be adjusted.</td></tr>
<tr><td colspan="2">Scan time for operating user program</td><td>Please refer to D8010</td></tr>
<tr><td rowspan="2">Delay time for output terminal</td><td>Delay time for general output terminal</td><td>Relay type: about 5ms。
Transistor type: about 15us。</td></tr>
<tr><td>Delay time for pulse output terminal of H type.</td><td>About 5 us (only for transistor type)</td></tr>
</table>

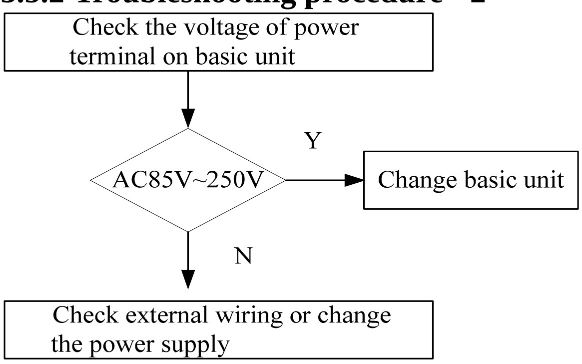
3.5 Troubleshooting procedure

3.5.1 Troubleshooting procedure - 1

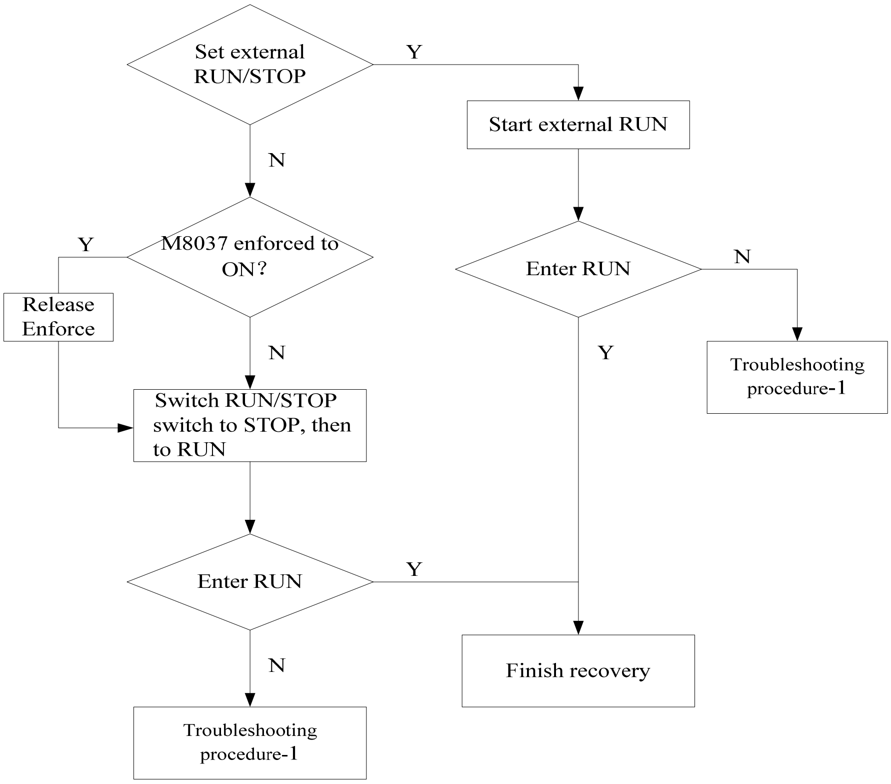
M register		D register		Continue to operate
No.	Function	No.	Error code description	
8060	Expansion card error	8060	Error code :200x: Expansion card not adapt to x: card install in fact 1:TP03-6AV 2:TP03-485RS 3:TP03-232RS 4:TP03-2AI 5:TP03-2TI 6:TP03-10P 6006:no communication card	Y
8061	PC hardware check	8061	Error code 0000: No error 6101: RAM error 6102: ROM error 6103: Basic unit I/O bus error 6104: User program error 6105: watchdog time detecting over time	N
8063	Communication error	8063	6301:DTLK error 6302:RMIO error	Y
8064	Parameter error	8064	Error code 0000: No error 6401: program and parameter is not corresponding 6402: register capacity set error 6409: other error	N
8065	Syntax error	8065	Error code 0000: no error 6501: instruction address error 6504: pointer repeated 6505: device address is beyond range 6506: using undefined instruction 6507: Pointer error 6508: Interruption pointer error 6509: other	N
8066	Program error	8066	Error code 0000: no error 6603: MPS continuously used for more than 8 times 6604: MPS MRD MPP relation error 6605: STL continuously used for more than 10 times 6606: no known label 6607: Main program has I and SRET 6609: CALL has more than 16 levels nest. 6610: for next are not corresponding 6611: with JCS and without JCR 6612: with STL and without RET 6613: with MC and without MCR 6614: with SMCS and without SMCR 6615: with I and without IRET 6616: MC, MCR I, SRET between 6617:for,next has more than 16 levels nest. 6618: no end 6621: other error	N

M register		D register		Continue to operate
No.	Function	No.	Error code description	
8067	Operation error	8067	Error code 6705: address error 6706: parameter error 6730: sampling time out of range(Ts<0) 6732: PID input filter out of range 6733: PID proportional gain out of range (Kp) 6734: PID integral time const out of range.(TI) 6735: PID Derivative gain out of range.(KD) 6736: PID Derivative time const out of range 6740: PID sampling time ≤ scan cycle 6742: Overflow of variational value about measuring in PID 6743: Overflow of deviated value in PID 6744: Overflow of integration computation in PID 6745: Overflow of differential grain leads to overflow of differential value in PID 6746: Overflow of differential computation values in PID 6747: Overflow of PID computation results 6750: SV-PVnf<150,or system is unstable 6751: Large Overshoot of the Set Value 6752: Large fluctuations during Autotuning Set Process	Y
8069	I/O bus error		6903: expansion I/O error 6904: expansion A/D error 6905:expansion A/D unit is power off	Y

3.5.2 Troubleshooting procedure - 2



3.5.3 Troubleshooting procedure - 3



3.5.4 Troubleshooting procedure - 4

This procedure is designed for input signal error which can not be detected by CPU self-diagnose.
Error example:

- None of input and output terminals on basic unit and expansion unit can set ON.
- Certain input can not be set ON/OFF.
- Sometimes a given input signal can affect other input signals on same basic unit or expansion unit.

Resolution

1. Check the power supply of TP03 and the wiring. If that is OK, please go on.
2. As for the input signal, the ON level should be above 15V while OFF level should be below 9V. If not, please modify it. If that is OK, please go on.
3. Cut all the power supply for devices connected to input terminal (as switch and proximity switch…).
4. Add an external +24vDC power supply to input terminal and common terminals.
   - The input indicator should be ON.
   - The input indicator should be OFF as the power is cut.
5. Check the input indicator on basic unit and expansion unit.
6. Supervise ON/OFF state of input relays with PC or PDA linked.
7. If the above state is normal, that is OK (that is to say, the responding indicator will be on as it is supplied with +24VDC, while off as the +24VDC is cut). Otherwise, please change the basic unit or expansion unit.
8. The input point will not act as expected when the electronic switch has large leakage current.
9. If none of the said item is wrong, but there is still error with input signal, please check the noise source or whether there has conductive thing inside PLC.
10. If there still be a problem after above check, please contact with after-sale service department for support.

3.5.5 Troubleshooting procedure - 5

This procedure is designed for output signal error which can not be detected by CPU self-diagnose.

Error example:

- None of output terminals on a certain basic unit or expansion unit can set ON. (Normally, the fuse for output is melted.)
- Certain output can not be set ON/OFF.
- Sometimes an output signal can affect other output signals on same basic unit or expansion unit.

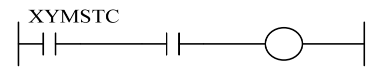
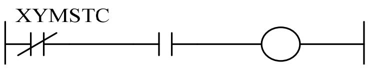
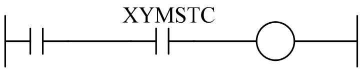
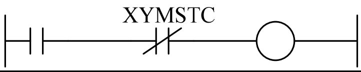
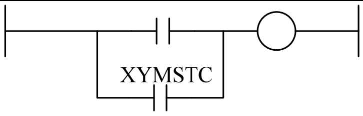
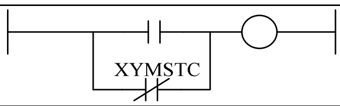
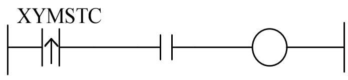
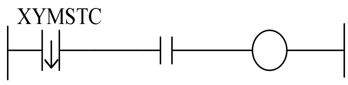
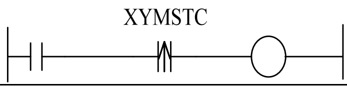
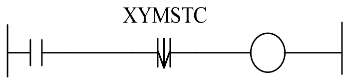
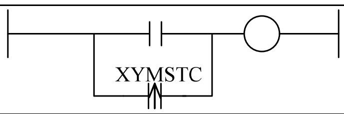
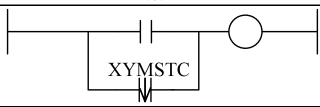
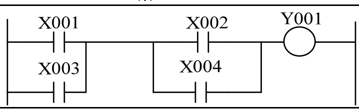
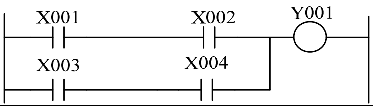
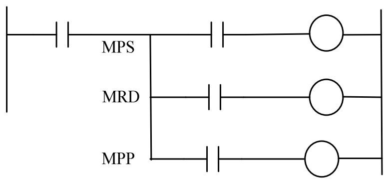
Resolution

1. Check the power supply of TP03 and the wiring. If that is OK, please go on.
2. Connect PC/ PDA. Supervise the ON/OFF state of data memory (relay output type) related to error.
3. Check
   - When output is ON, the indicator should be lit and voltage between output will be below 1.2V;
   - When output is OFF, the indicator should be OFF and voltage between outputs will be equal to power supply voltage.
4. Check the output indicator on basic unit and expansion unit
5. If the above state is normal, that is OK (that is to say, the responding indicator will be lit as output is ON, while off as the output is OFF). Otherwise, please change the basic unit or expansion unit.
6. If none of the said item is wrong, but there is still error with input signal, please check the noise source or whether there has conductive thing inside PLC.
7. If there still be a problem after above check, please contact with after-sale service department for support.

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Chapter 7 Instruction List

1 Basic sequential instruction

Mnemonic	Function	Circuit	Step
[LD]	Initial logical operation contact type NO (normally open)		1
[LDI]	Initial logical operation contact type NC (normally closed)		1
[AND]	Serial connection of NO (normally open) contacts		1
[ANI]	Serial connection of NC (normally closed) contacts		1
[OR]	Parallel connection of NO (normally open) contacts		1
[ORI]	Parallel connection of (normally closed) contacts		1
[LDP]	Initial logical operation -Rising edge pulse		2
[LDF]	Initial logical operation Falling/ trailing edge pulse		2
[ANDP]	Serial connection of Rising edge pulse		2
[ANDF]	Serial connection of Falling /trailing edge pulse		2
[ORP]	Parallel connection of Rising edge pulse		2
[ORF]	Parallel connection of Falling / trailing edge pulse		2
[ANB]	Serial connection of multiple contact circuits		1
[ORB]	Parallel connection of multiple contact circuits		1
[MPS]	Stores the current result of the internal PLC operations		1
[MRD]	Reads the current result of the internal PLC operations		1
[MPP]	Pops (recalls and removes) the currently stored result		1

Mnemonic	Function	Circuit	Step
[INV]	Inverse	X001 INV Y001	1
[MC]	Denotes the start of a master control block	X001 MC N YM	3
[MCR]	Denotes the end of a master control block	X001 MCR N	2
[NOP]	No operation		1
[END]	Program End		1
[STL]	Step ladder		1
[RET]	Step ladder return		1
[PLS]	Rising edge pulse	X001 PLS YM	2
[PLF]	Falling / trailing edge pulse	X001 PLF YM	2
[P]	Pointer		
[I]	Interruption pointer		
[OUT]	Driving timer or counter coils	XYMSTC	Y&M:1
[OUTI]			2
[OUT T]			T :3
[OUT C]			C :3/5
[OUT S]			2
[SET]	Sets a bit device permanently ON	X001 SET YMS	Y,M:1 S, special M:2 T,C:2 special D:3
[RST]	Resets a bit device permanently OFF	X001 RST YMS	Y,M:1 S, special M:2 T,C:2 D&V&Z& special D:3
[SMCS]	Master control set	SMCS	1
[SMCR]	Master control reset	SMCR	1
[JCS]	Jump control set	JCS	1
[JCR]	Jump control reset	JCR	1

Note: The step for [LD],[LDI],[AND],[ANDI],[OR],[ORI] with operand M1536~M7679 or S1024~4095 is 2.

The step for [OUT] with operand M1536~M7679 or S is 2.

The step for [SET],[RST] with operand M1536~M7679, M8000~80511 and S is 2.

2 Step instruction :STL, RET

Mnemonic	Function	Circuit	Step
[STL]	Step ladder		1
[RET]	Step ladder return	RET	1

3 Application instruction list

Instruction type	Application instruction			16/32 Bit	P	Step		Type		
	No.	Mnemonic	function			32bit	16bit	S	M	H
Program flow	00	CJ	Conditional jump	16	√	——	3	○	○	○
	01	CALL	Call subroutine	16	√	——	3	○	○	○
	02	SRET	Subroutine return	16		——	1	○	○	○
	03	IRET	Interrupt return	*1		——	1	○	○	○
	04	EI	Enable interrupt	*1		——	1	○	○	○
	05	DI	Disable interrupt	*1		——	1	○	○	○
	06	FEND	First end	*1		——	1	○	○	○
	07	WDT	Waterdog timer	16	√	——	1	○	○	○
	08	FOR	Start of a for/next loop	*1		——	3	○	○	○
	09	NEXT	End a for/next loop	*1		——	1	○	○	○
Move and compare	10	CMP	Compare	16/ 32	√	13	7	○	○	○
	11	ZCP	Zone compare	16/ 32	√	17	9	○	○	○
	12	MOV	Move	16/ 32	√	9	5	○	○	○
	13	SMOV	Shift move	16	√	——	11	○	○	○
	14	CML	Compliment	16/ 32	√	9	5	○	○	○
	15	BMOV	Block move	16	√	——	7	○	○	○
	16	FMOV	Fill move	16/ 32	√	13	7	○	○	○
	17	XCH	Exchange	16/ 32	√	9	5	○	○	○
	18	BCD	BCD binary coded decimal	16/ 32	√	9	5	○	○	○
	19	BIN	BIN binary	16/ 32	√	9	5	○	○	○
Arithmetic and logic operations	20	ADD	Addition	16/ 32	√	13	7	○	○	○
	21	SUB	Subtraction	16/ 32	√	13	7	○	○	○
	22	MUL	Multiplication	16/ 32	√	13	7	○	○	○
	23	DIV	Division	16/ 32	√	13	7	○	○	○
	24	INC	Increment	16/ 32	√	5	3	○	○	○
	25	DEC	Decrement	16/ 32	√	5	3	○	○	○
	26	WAND	Word and	16/ 32	√	13	7	○	○	○
	27	WOR	Word or	16/ 32	√	13	7	○	○	○
	28	WXOR	Word exclusive or	16/ 32	√	13	7	○	○	○
	29	NEG	Negation	16/ 32	√	5	3	○	○	○
Rotation and shift	30	ROR	Rotation right	16/ 32	√	9	5	○	○	○
	31	ROL	Rotation left	16/ 32	√	9	5	○	○	○
	32	RCR	Rotation right with carry	16/ 32	√	9	5	○	○	○
	33	RCR	Rotation left with carry	16/ 32	√	9	5	○	○	○
	34	SFTR	Bit shift right	16	√	——	9	○	○	○
	35	SFTL	Bit shift left	16	√	——	9	○	○	○
	36	WSFR	Word shift right	16	√	——	9	○	○	○
	37	WSFL	Word shift left	16	√	——	9	○	○	○

Instruction list

Instruction type	Application instruction			16/32 Bit	P	Step		Type		
	No.	Mnemonic	function			32bit	16bit	S	M	H
	38	SFWR	Shift register write	16	√	—	7	○	○	○
	39	SFRD	Shift register read	16	√	—	7	○	○	○
Data operation	40	ZRST	Zone reset	16	√	—	5	○	○	○
	41	DECO	Decode	16	√	—	7	○	○	○
	42	ENCO	Encode	16	√	—	7	○	○	○
	43	SUM	Sum of active bits	16/ 32	√	9	5	○	○	○
	44	BON	Check specified but status	16/ 32	√	13	7	○	○	○
	45	MEAN	Mean	16/ 32	√	13	7	○	○	○
	46	ANS	Timed annunciator set	16		—	7	○	○	○
	47	ANR	Annuciator reset	16	√	—	1	○	○	○
	48	SQR	Square root	16/ 32	√	9	5	○	○	○
	49	FLT	Float point	16/ 32	√	9	5	○	○	○
High speed processing	50	REF	Refresh	16	√	—	5	○	○	○
	52	MTR	Input matrix	16		—	9	○	○	○
	53	HSCS	High speed counter set	32		13	—	○	○	○
	54	HSCR	High speed counter reset	32		13	—	○	○	○
	55	HSZ	High speed counter zone compare	32		17	—	○	○	○
	56	SPD	Speed detect	16		—	7	○	○	○
	57	PLSY	Pulse Y output	16/32		13	7	—	○	○
	58	PWM	Pulse width modulation	16		—	7	—	○	○
	59	PLSR	Ramp pulse output	16/32		17	9	—	○	○
Handy instruction Handy instruction	60	IST	Initial state	16		—	7	○	○	○
	61	SER	Search	16/32		17	9	○	○	○
	62	ABSD	Absolute drum	16/32		17	9	○	○	○
	63	INCD	Incremental drum	16		—	9	○	○	○
	64	TTMR	Teaching timer	16		—	5	○	○	○
	65	STMR	Special timer- definable	16		—	7	○	○	○
	66	ALT	Alternate state	16	√	—	3	○	○	○
	67	RAMP	Ramp-variable value	16		—		○	○	○
	68	ROTC	Rotary table control	16		—		○	○	○
	69	SORT	Sort data	16		—		○	○	○
External I/O device	70	TKY	Ten key input	16/32		13	7	○	○	○
	71	HKY	Hexadecimal input	16/32		17	9	○	○	○
	72	DSW	Digital switch	16		—	9	○	○	○
	73	SEGD	Seven segment decoder	16	√	—	5	○	○	○
	74	SEGL	Seven segment with latch	16		—	7	○	○	○
	75	ARWS	Arrow switch	16		—	9	○	○	○
	76	ASC	ASCII code	16		—	11	○	○	○
	77	PR	Print to a display	16		—	5	○	○	○

Instruction type	Application instruction			16/32 Bit	P	Step		Type		
	No.	Mnemonic	function			32bit	16bit	S	M	H
External serial devices	80	RS	RS communications			—	9	○	○	○
	82	ASIC	HEX-ASCII	16/32	√	—	7	○	○	○
	83	HEX	ASCII-HEX	16/32	√	—	7	○	○	○
	84	CCD	Check code	16/32	√	—	7	○	○	○
	85	VRRD	Volume read	16	√	—	5	—	○	○
	86	DRSC	Volume scale	16	√	—	5	—	○	○
	87	MBUS	MODBUS	16	√	—	11	○	○	○
	88	PID	PID control loop	16		—	9	○	○	○
	89	EPSC	Read scale from Expansion card	16	√	—	9	—	○	○
Floating points and trigonometry	110	ECMP	Float compare	32	√	13	—	○	○	○
	111	EZCP	Float zone compare	32	√	17	—	○	○	○
	118	EBCD	Float to scientific	32	√	9	—	○	○	○
	119	EBIN	Scientific to float	32	√	9	—	○	○	○
	120	EADD	Float add	32	√	13	—	○	○	○
	121	ESUB	Float subtract	32	√	13	—	○	○	○
	122	EMUL	Float multiplication	32	√	13	—	○	○	○
	123	EDIV	Float division	32	√	13	—	○	○	○
	127	ESQR	Float square root	32	√	9	—	○	○	○
	129	INT	Float - integer	16/32	√	9	5	○	○	○
	130	SIN	Sine	32	√	9	—	○	○	○
	131	COS	cosine	32	√	9	—	○	○	○
	132	TAN	Tangent	32	√	9	—	○	○	○
	133	ASIN	Arc sine	32	√	9	—	○	○	○
	134	ACOS	Arc cosine	32	√	9	—	○	○	○
	135	ATAN	Arc tangent	32	√	9	—	○	○	○
	136	RAD	Degree — RAD	32	√	9	—	○	○	○
	137	GRE	RAD — Degree	32		9	—	○	○	○
Data operation	147	SWAP	Float to Scientific	16/32	√	5	3	○	○	○
Position	156	ZRN	Zero return	16/32		17	9	—	○	○
	157	PLSV	Pulse V	16/32		13	7	—	○	○
	158	DRVI	Drive to increment	16/32		17	9	—	○	○
	159	DRVA	Drive to absolute	16/32		17	9	—	○	○
Real time clock control	160	TCMP	Time compare	16		——	11	—	—	○
	161	TZCP	Time zone compare	16		——	9	—	—	○
	162	TADD	Time add	16		——	7	—	—	○
	163	TSUB	Time subtract	16		——	7	—	—	○
	166	TRD	Read RTC data	16		——	3	—	—	○
	167	TWR	Set RTC data	16		——	3	—	—	○

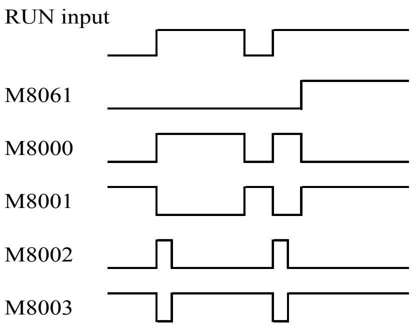
Instruction type	Application instruction			16/32 Bit	P	Step		Type		
	No.	Mnemonic	function			32bit	16bit	S	M	H
Gray code	170	GRY	Decimal to Gray Code	16/32	√	9	5	○	○	○
	171	GBIN	Gray Code to Decimal	16/32	√	9	5	○	○	○
communication	188	CRC	Cyclical Redundancy Check	16		—	7	○	○	○
	190	DTLK	Data Link	16		—	3	○	○	○
	191	RMIO	Remote I/O	16		—	3	○	○	○
	192	TEXT	OP07/08 text	16	√	—	7	○	○	○
Inline comparison	224	LD	(S1)=(S2)	16/32		9	5	○	○	○
	225		LD (S1)>(S2)	16/32		9	5	○	○	○
	226		LD (S1)<(S2)	16/32		9	5	○	○	○
	228		LD (S1)≠(S2	16/32		9	5	○	○	○
	229		LD (S1)≦(S2	16/32		9	5	○	○	○
	230		LD (S1)≧(S2	16/32		9	5	○	○	○
	232		AND (S1)=(S2)	16/32		9	5	○	○	○
	233		AND (S1)>(S2)	16/32		9	5	○	○	○
	234		AND (S1)<(S2)	16/32		9	5	○	○	○
	236		AND (S1)≠(S2	16/32		9	5	○	○	○
	237		AND (S1)≦(S2	16/32		9	5	○	○	○
	238		AND (S1)≧(S2	16/32		9	5	○	○	○
	240		OR (S1)=(S2)	16/32		9	5	○	○	○
	241		OR (S1)>(S2)	16/32		9	5	○	○	○
	242		OR (S1)<(S2)	16/32		9	5	○	○	○
	244		OR (S1)≠(S2	16/32		9	5	○	○	○
	245		OR (S1)≦(S2	16/32		9	5	○	○	○
	246		OR (S1)≧(S2	16/32		9	5	○	○	○

Chapter 8 Special Relay

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PC status (M)

Device No.	Function	Operation
8000	RUN monitor (NO contact)	
8001	RUN monitor (NC contact)	
8002	Initial pulse (NO contact)	
8003	Initial pulse (NC contact)	
8004	Error occurrence	ON when one or more flags of M8061,M8064~ M8067 are ON
8005	Warning occurrence	ON when one or more flags of M8060,M8063, M8069 are ON
8006	Battery low voltage	ON when battery voltage is too low. OFF when a new battery is installed.
8007	Latch for battery low voltage	ON when battery voltage is too low.

Clock device（M）

Device No.	Function	Operation
8011	10ms period oscillator	5ms ON/5ms OFF
8012	100ms period oscillator	50ms ON/50ms OFF
8013	1s period oscillator	0.5s ON/0.5s OFF
8014	1min period oscillator	30s ON/30s OFF
8015	Clock stop and set	Stop timing and reset the clock
8016	Stop displaying clock time	Stop displaying clock time
8017	+/-30s offset	+/-30 s offset for internal time
8018	RTC detection	Check whether RTC is enabled.
8019	RTC error	Clock is set out of the range.

Operation flags（M）

Device No.	Function	Operation
8020	Zero	On when the result of add or subtract is 0
8021	Borrow	On when the result of subtract is smaller than the minimum negative number of the system
8022	Carry	ON when the result of add should be carry
8023		
8024	BMOV direction	(F15) 0: forward,1:reverse
8026	RAMP mode	(F67)0: reset, 1: keep
8027	PR mode	（F77）0: 8bytes;1: 16bytes
8029	Instruction execution ends	ON when the instruction as DSW(F72) is finished

Chapter 8 Special Relay

PC status（D）

Device No.	Function	Operation
8001	TP03 type	0x
8002	Version	10 represents 1.0 version
8004	Error code	
8005	Warning code	

RTC（D）

Device No.	Function	Operation
8010	Present scan time(1ms unit)	
8011	Min scan time	
8012	Max scan time	
8013	Second (0~59)	
8014	Minute (0~59)	
8015	Hour	
8016	Day	
8017	Month	
8018	Year (2000~2099)	
8019	Week	

Chapter 8 Special Relay

PC operation mode（M）

Device No.	Function	Operation
8030	No-battery mode	
8031	Non-retentive register all clear(when executing END instruction)	When M8031 ON, the ON/ OFF status Y/M/S/T/C and present value of T/C/D are reset. However, special Data register will not be cleared.
8032	Retentive register all clear(when executing END instruction)	When M8032 ON, the retentive registers are reset.
8033	Register hold in stop mode *note:1*	Saving mode for Register 0: STOP→RUN, TP03 saves according to requirement 1: STOP→RUN,TP03 saves all data
8034	Output prohibit	1: output 0; 0: output Y
8035	Enforced operation mode	When M8035 on, the No. of X input which D8035 specified can be used for RUN control
8036	Enforced Run instruction	When M8036 on, the PLC will switch into RUN
8037	Enforced Stop instruction	When M8037 on, the PLC will switch into STOP
8039	Constant scan mode	1: ENABLE; 0: DISABLE This register will not be initiated in Power ON.

PC mode（D）

Device No.	Function	Operation
8039	Constant scan time	Default: 0, unit: ms

Step ladder flags (M)

Device No.	Function	Operation
8040	STL transfer disable	M8040 ON, STL transfer is disabled.
8041	STL transfer start	When M8041 ON, STL state transfer is enabled in automatic operation
8046	STL state ON	When M8047 is ON and any one of S0~S899 is on, M8064 will be ON.
8047	Enable STL monitor	As long as M8047 is ON, D8040~D8047 are enabled.
8048	Annunciator ON	If M8049 ON, and any one of S900~S999 is on, M8048 will be ON
8049	Enable Annunciator	M8049 ON, D8049 is enabled.

Chapter 8 Special Relay

Step ladder flags (D)

Device No.	Function	Operation
8040	Address for ON State	
8041		
8042		
8043		
8044		
8045		
8046		
8047		
8048		
8049	The minimum address for ON State among (S900 ~ S999)	

Interruption disable（M）

Device No.	Function	Operation
8050	Input interruption disable(I00x)	ON: forbid interrupt Initial to ON when stop to run interruption disable
8051	Input interruption disable(I10x)	
8052	Input interruption disable(I20x)	
8053	Input interruption disable(I30x)	
8054	Input interruption disable(I40x)	
8055	Input interruption disable(I50x)	
8056	Timing interruption disable(I6xx)	
8057	Timing interruption disable(I7xx)	
8058	Timing interruption disable(I8xx)	
8059	Counting interruption disable (I010~I060)	

UP/DOWN counting set device（M）

Device No.	Function	Operation
8200	UP/DOWN counting set for C200	
8201	UP/DOWN counting set for C201	
8202	UP/DOWN counting set for C202	
8203	UP/DOWN counting set for C203	
8204	UP/DOWN counting set for C204	
8205	UP/DOWN counting set for C205	
8206	UP/DOWN counting set for C206	
8207	UP/DOWN counting set for C207	
8208	UP/DOWN counting set for C208	
8209	UP/DOWN counting set for C209	
8210	UP/DOWN counting set for C210	
8211	UP/DOWN counting set for C211	
8212	UP/DOWN counting set for C212	

Device No.	Function	Operation
8213	UP/DOWN counting set for C213	
8214	UP/DOWN counting set for C214	
8215	UP/DOWN counting set for C215	
8216	UP/DOWN counting set for C216	
8217	UP/DOWN counting set for C217	
8218	UP/DOWN counting set for C218	
8219	UP/DOWN counting set for C219	
8220	UP/DOWN counting set for C220	
8221	UP/DOWN counting set for C221	
8222	UP/DOWN counting set for C222	
8223	UP/DOWN counting set for C223	
8224	UP/DOWN counting set for C224	
8225	UP/DOWN counting set for C225	
8226	UP/DOWN counting set for C226	
8227	UP/DOWN counting set for C227	
8228	UP/DOWN counting set for C228	
8229	UP/DOWN counting set for C229	
8230	UP/DOWN counting set for C230	
8231	UP/DOWN counting set for C231	
8232	UP/DOWN counting set for C232	
8233	UP/DOWN counting set for C233	
8234	UP/DOWN counting set for C234	
8241	UP/DOWN counting set for C241	
8242	UP/DOWN counting set for C242	
8243	UP/DOWN counting set for C243	
8244	UP/DOWN counting set for C244	
8245	UP/DOWN counting set for C245	
8246	UP/DOWN counting set for C246	
8247	UP/DOWN counting set for C247	
8248	UP/DOWN counting set for C248	
8249	UP/DOWN counting set for C249	
8250	UP/DOWN counting set for C250	
8251	UP/DOWN counting monitor for C251	
8252	UP/DOWN counting set for C252	
8253	UP/DOWN counting monitor for C253	
8254	UP/DOWN counting set for C254	
8255	UP/DOWN counting set for C255	

Chapter 8 Special Relay

Devices（M）

Device No.	Function	Operation
8060	Expansion card error	
8061	PLC hardware check	PLC hardware error
8063	Communication error	
8064	Parameter check	
8065	Syntax check	
8066	Program check	
8067	Operation check	
8068	retain	
8109	Output update check	
8069	Expansion unit check	

Error detection（D）

Device No.	Function	Operation
8060	Error code	Refer to chapter 6 -3.5.1
8061	Error code	
8063	Error code	
8064	Error code	
8065	Error code	
8066	Error code	
8067	Error code	
8069	Error code	

Communication and link (M) I

For RS485 port

Device No.	Function	Operation
8121	RS485 communication port send data is ready	RS, MBUS
8122	RS485 communication port sending flag	RS, MBUS
8123	RS485 communication port receiving data end flag	RS, MBUS
8124	RS485 communication port MBUS instruction error	MBUS
8129	RS485 communication port communication over time.	RS, MBUS

Chapter 8 Special Relay

For expansion communication port

Device No.	Function	Operation
8321	Expansion communication port send data is ready	RS,MBUS
8322	Expansion communication port sending flag	RS,MBUS
8323	Expansion communication port receiving data end flag	RS,MBUS
8324	Expansion communication port MBUS instruction error	MBUS
8329	Expansion communication port communication over time.	RS,MBUS

For RMIO

Device No.	Function	Operation
8335	RMIO data in transmission	
8336	RMIO data transmission error (master)	
8337	RMIO data transmission error (slave 1)	
8338	RMIO data transmission error (slave 2)	
8339	RMIO data transmission error (slave 3)	
8340	RMIO data transmission error (slave 4)	
8341	Expansion communication port is under RMIO	
8342	RS 485 communication port is under RMIO	

Chapter 8 Special Relay

Communication and link (D) I

For RS485 port

Device No.	Function	Operation
8120	Communication format	RS485 communication port 89Hex
8121	Address	Read-only default: 01
8122	Remaining data number of RS485 sending data	
8123	Number of RS485 Data received	
8124	Start character	RS485 communication port, RS instruction 02Hex
8125	End character	RS485 communication port, RS instruction 03Hex
8129	Communication watchdog time	RS485 communication port, RS and MBUS instruction

For expansion communication port

Device No.	Function	Operation
8320	Communication format	Expansion communication port（RS485/RS232） 89Hex
8321	Address	PC/PDA communication port 89HEx
8322	Remaining data number of sending data	Expansion communication port
8323	Number of RS485 Data received	Expansion communication port
8324	Start character	Expansion communication port, RS instruction 02Hex
8325	End character	Expansion communication port RS instruction 03Hex
8329	Communication watchdog time	Expansion communication port (RS and MBUS)

Chapter 8 Special Relay

For RMIO

Device No.	Function	Operation
8373	RMIO slave setting state	
8374	RMIO slave setting	
8376	RMIO slave	
8377	RMIO slave number setting	
8379	RMIO retry times	
8380	RMIO monitor time	
8331	Current scan time	
8332	Max scan time	
8333	Error counting number (master)	
8334	Error counting number (slave 1)	
8335	Error counting number (slave 2)	
8336	Error counting number (slave 3)	
8337	Error counting number (slave 4)	
8338	Error code (master)	
8339	Error code (slave 1)	
8340	Error code (slave 2)	
8341	Error code (slave 3)	
8342	Error code (slave 4)	

Chapter 8 Special Relay

Communication and link (M) II

DTLK

Device No.	Function	Operation
8400	Data sending error (master)	
8401	Data sending error(slave 1)	
8402	Data sending error(slave 2)	
8403	Data sending error(slave 3)	
8404	Data sending error(slave 4)	
8405	Data sending error(slave 5)	
8406	Data sending error(slave 6)	
8407	Data sending error(slave 7)	
8408	Data sending error(slave 8)	
8409	Data sending error(slave 9)	
8410	Data sending error(slave 10)	
8411	Data sending error(slave 11)	
8412	Data sending error(slave 1 2)	
8413	Data sending error (slave 13)	
8414	Data sending error(slave 14)	
8415	Data sending error(slave 15)	
8416	Data sending	
8417	Expansion communication port is set as DTLK	
8418	RS485 port is set as DTLK	

Chapter 8 Special Relay

Communication and link (D) II

DTLK

Device No.	Function	Operation
8173	Set state of master	Data Link
8174	Set state of slave	Data Link
8175	Set state of refresh range	Data Link
8176	set Master address	Data Link
8177	set Slaver address	Data Link
8178	set Refresh range	Data Link
8179	Retry times	Data Link
8180	Monitor time	Data Link
8401	Current scan time	
8402	Max scan time	
8403	Error counting number (master)	
8404	Error counting number (slave1)	
8405	Error counting number (slave2)	
8406	Error counting number (slave3)	
8407	Error counting number (slave4)	
8408	Error counting number (slave5)	
8409	Error counting number (slave6)	
8410	Error counting number (slave7)	
8411	Error counting number (slave8)	
8412	Error counting number (slave9)	
8413	Error counting number (slave10)	
8414	Error counting number (slave11)	
8415	Error counting number (slave12)	
8416	Error counting number (slave13)	
8417	Error counting number (slave14)	
8418	Error counting number (slave15)	
8419	Error code (master)	
8420	Error code (slave 1)	
8421	Error code (slave2)	
8422	Error code (slave3)	
8423	Error code (slave4)	
8424	Error code (slave5)	
8425	Error code (slave6)	
8426	Error code (slave7)	
8427	Error code (slave8)	
8428	Error code (slave9)	
8429	Error code (slave10)	
8430	Error code (slave11)	
8431	Error code (slave12)	
8432	Error code (slave13)	
8433	Error code (slave14)	
8434	Error code (slave15)	

Chapter 8 Special Relay

High speed and position (M)

Device No.	Function	Operation
8130	F55(HSZ) High speed counter zone compare mode	
8131	Finish flag for F55	
8132	F55(HSZ),F57(PLSY) speed mode	
8133	F55,F57 performing end flag	
8134	Reserved	
8135	Reserved	
8136	Reserved	
8137	Reserved	
8138	Reserved	
8139	Reserved	
8140	FNC156(ZRN)CLR signal output enable	
8141	Reserved	
8142	Reserved	
8143	Y000 pulse output finished	Available since V1.6
8144	Y001 pulse output finished	Available since V1.6
8145	Y000 pulse output stops	
8146	Y001 pulse output stops	
8147	Y000 pulse output monitoring (busy/read)	
8148	Y001 pulse output monitoring (busy/read)	
8149	Reserved	

PWM output（D）

Device No.	Function	Operation
8158	PWM Y0 time base	0： 1ms 1： 0.1ms 2： 0.01ms
8159	PWM Y1 time base	

*Note: S type has no function about PWM, M type only can be set to 0, H type can be set to 0,1,2.

Expansion （M）

Device No.	Function	Operation
8160	F17(XCH) SWAP	
8161	8 octal processing mode (F76,80,83,84, 87,188)	
8167	F71(HKY)HEX data processing	
8168	F13(SMOV)DE HEX processing	

Chapter 8 Special Relay

High speed and position（D）

Device No.	Function	Operation
8130	High speed counter zone compare	
8131	Contains the number of the current record being processed in the HSZ comparison table when the PLSY operation has been enabled	
8132	Frequency (HSZ, PLSY)	
8134	Target pulse	
8136	Accumulated value for output pulse of Y000 and Y001	
8140	F57, 59(PLSR), Accumulated value for output pulse of Y000 or present value of position instruction.	
8142	F57, 59(PLSR), Accumulated value for output pulse of Y001 or present value of position instruction.	
8145	Offset speed for F156,F158,F159	
8146	Fastest speed	
8148	Initial value	

Chapter 8 Special Relay

OP07/08（M）

Device No.	Function	Operation
8280	Key F1	
8281	Key F2	
8282	Key F3	
8283	Key F4	
8284	Key F5	
8285	Key F6	
8286	Key F7	
8287	Key F8	
8288	Key F9	
8289	Key F10	
8290	Key F11	
8291	Key F12	
8292	Up	
8293	Down	
8294	Left	
8295	Right	
8296	Key TMR	
8297	Key CNT	
8298	Key ENT	
8299	Key MOD1	
8300	Key MOD2	
8301	Key ESC	
8302	Reserved	
8303	Reserved	

Chapter 8 Special Relay

OP07/08（D）

Device No.	Function	Operation
8280	First line content defaulted	
8281	Second line content defaulted	
8282	First line content user defined	
8283	First line content user defined	
8284	OP07/08 display mode setting	
8285	OP07/08 present display mode	
8286	OP07/08 display number range	
8287	Error code	
8288		
8289	Present number for timer mode	
8290	Present number for Counter mode	
8291	Present number for user mode1	
8292	Present number for user mode2	
8293	Present number for user mode3	
8294	Present number for user mode4	
8295	First line content for F192 mode	
8296	Second line content for F192 mode	
8297	Data format set 1	
8298	Data format set 2	
8299	Data format set 3	
8300	Data format set 4	

Chapter 8 Special Relay

AD/DA (M)

Device No.	Function	Operation
8257	Total quantity of AD modules is wrong	
8258	Total quantity of DA module channel is wrong	

AD/DA (D)

Device No.	Function	Operation
8256	number of **modules** (TP02-4AD+)	As for the basic unit (20/30 points, SR type), only one group either D8256 & D8258 or D8257 & D8259 is available for setting.
8257	number of **modules** (TP03-AD)	
8258	Number of **channels** (TP02-DA modules)	
8259	Number of **channels** (TP03 DA modules)	
8260	AD filter mode	
8261	AD1~4 channel mode set	
8262	AD5~8 channel mode set	
8263	AD9~12 channel mode set	
8264	AD13~16 channel mode set	
8265	AD17~20 channel mode set	
8266	AD21~24 channel mode set	
8267	AD25~28 channel mode set	
8268	AD29~32 channel mode set	
8269	AD33~36 channel mode set	
8270	AD37~40 channel mode set	
8271	AD41~44 channel mode set	
8272	AD45~48 channel mode set	
8273	AD49~52 channel mode set	
8274	AD53~56 channel mode set	
8275	AD57~60 channel mode set	
8276	Reserved	
8277	DA1~4 channel mode set	
8278	DA5~8 channel mode set	
8279	DA9~10 channel mode set	
8381	DA channel 1data	
8382	DA channel 2data	
8383	DA channel 3data	

Chapter 8 Special Relay

Device No.	Function	Operation
8384	DA channel 4data	
8385	DA channel 5data	
8386	DA channel 6 data	
8387	DA channel 7 data	
8388	DA channel 8 data	
8389	DA channel 9 data	
8390	DA channel 10 data	
8436	AD channel 1 data	
8437	AD channel 2 data	
8438	AD channel 3 data	
8439	AD channel 4 data	
8440	AD channel 5 data	
8441	AD channel 6 data	
8442	AD channel 7 data	
8443	AD channel 8 data	
8444	AD channel 9 data	
8445	AD channel 10 data	
8446	AD channel 11 data	
8447	AD channel 12 data	
8448	AD channel 13 data	
8449	AD channel 14 data	
8450	AD channel 15 data	
8451	AD channel 16 data	
8452	AD channel 17 data	
8453	AD channel 18 data	
8454	AD channel 19 data	
8455	AD channel 20 data	
8456	AD channel 21 data	
8457	AD channel 22 data	
8458	AD channel 23 data	
8459	AD channel 24 data	
8460	AD channel 25 data	
8461	AD channel 26 data	
8462	AD channel 27 data	
8463	AD channel 28 data	
8464	AD channel 29 data	
8465	AD channel 30 data	
8466	AD channel 31 data	
8467	AD channel 32 data	
8468	AD channel 33 data	
8469	AD channel 34 data	

Device No.	Function	Operation
8470	AD channel 35 data	
8471	AD channel 36 data	
8472	AD channel 37 data	
8473	AD channel 38 data	
8474	AD channel 39 data	
8475	AD channel 40 data	
8476	AD channel 41 data	
8477	AD channel 42 data	
8478	AD channel 43 data	
8479	AD channel 44 data	
8480	AD channel 45 data	
8481	AD channel 46 data	
8482	AD channel 47 data	
8483	AD channel 48 data	
8484	AD channel 49 data	
8485	AD channel 50 data	
8486	AD channel 51 data	
8487	AD channel 52 data	
8488	AD channel 53 data	
8489	AD channel 54 data	
8490	AD channel 55 data	
8491	AD channel 56 data	
8492	AD channel 57 data	
8493	AD channel 58 data	
8494	AD channel 59 data	
8495	AD channel 60 data	

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